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By Eva March Tappan

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By Eva March Tappan

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The Young People's Information Series

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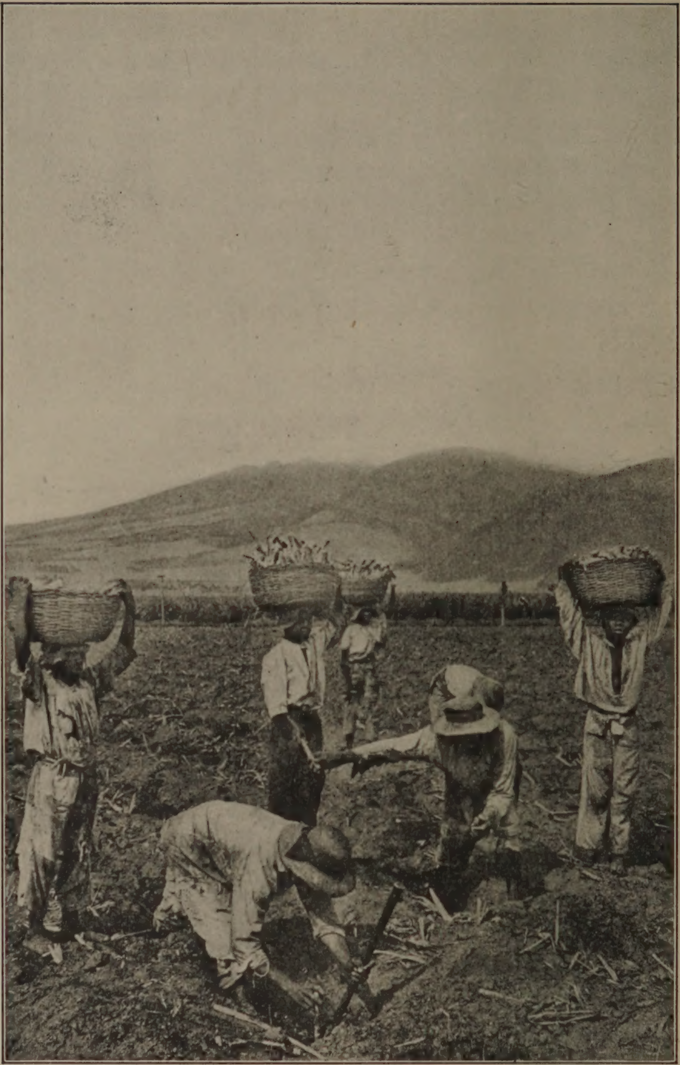
THE FARMER AND HIS FRIENDS



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PLANTING SUGAR CANE, ST. KITTS, BRITISH WEST INDIES
The cane requires renewing but once in seven years. It is propagated from cuttings.

THE FARMER AND HIS FRIENDS

BY

EVA MARCH TAPPAN, Ph.D.

BOSTON AND NEW YORK
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PREFACE

The four books of this series have been written not merely to provide agreeable reading matter for children, but to give them information. When a child can look at a steel pen not simply as an article furnished by the city for his use, but rather as the result of many interesting processes, he has made a distinct growth in intelligence. When he has begun to apprehend the fruitfulness of the earth, both above ground and below, and the best way in which its products may be utilized and carried to the places where they are needed, he has not only acquired a knowledge of many kinds of industrial life which may help him to choose his life-work wisely from among them, but he has learned the dependence of one person upon other persons, of one part of the world upon other parts, and the necessity of peaceful intercourse. Best of all, he has learned to see. Wordsworth's familiar lines say of a man whose eyes had not been opened, —

> "A primrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more."

These books are planned to show the children that there is "something more"; to broaden their horizon; to reveal to them what invention has accomplished and what wide room for invention still remains; to teach them that reward comes to the man who improves his output beyond the task of the moment; and that success is waiting not for him who works because he must, but him who works because he may.

Acknowledgment is due to Professor W. J. Spillman, of the Bureau of Plant Industry at Washington, whose advice and criticism have been of most valuable aid in the preparation of this volume.

EVA MARCH TAPPAN.

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THE FARMER AND HIS FRIENDS

I

THE FARMER OF TO-DAY

Everything that we eat or drink or wear comes either directly or indirectly from the earth; and the earth will always do her share of providing it if we do ours.

Not many years ago, people used to carry on farms in a sort of hit-or-miss fashion. If the potatoes were soggy, they said there had been too much rain. If the peas were hard and shriveled, they said the summer had been terribly dry. If the corn did not ripen, they blamed the early frosts. If an apple tree ceased to bear and began to decay, they looked at it with regret and said, "What a pity!" If the young turkeys died, they recalled the tradition that turkeys were always hard to raise. Hens were of no particular breed and had no special care. If they were thirsty, they drank — if they could find any water. They caught grasshoppers as best they could, and they waited hungrily about the back door for crumbs from the dinner table. They laid no eggs in the cold weather, and the farmers said patiently, "Hens never do lay in the winter."

It is no wonder that farming rarely paid. No business would pay if it were carried on in this fashion. But now there are new ways of farming. If anything goes wrong, the farmer sets to work to find out what makes the trouble and what will cure it. If the potatoes are soggy, he knows that the land needs draining. If the peas are in danger of shriveling, he brings in water by pipes or ditches. If the corn does not ripen, he seeks for a variety that does not need so long a season, and so is suitable to his climate. If an apple tree is apparently dying, he prunes it, fills up holes, puts fertilizer around it, and sprays it for gypsy moths and San José scale. If the young turkeys do not do well, he keeps them out of the wet grass and looks after their food and comfort. The breed of his hens is carefully chosen. They do not hang around the back door for crumbs or waste their strength and fatness in chasing grasshoppers, because food and drink are kept constantly before them. The old saying was that the time of a sitting hen is not worth much; but when "February broilers" will sell for seventy-five cents a pound, the farmer finds that the incubator, which will work whenever he wants it to, is more economical than the hen. And as for eggs in winter, he has learned that pullets hatched in the spring have no objection to laying eggs throughout their first winter if they are kept warm and comfortable.

The farmers who succeed are carrying on their

Courtesy Soc. for Control of Tuberculosis, Boston.

HARVESTING HER CORN CROP

One of the children in the school garden in a big city. She has planted, hoed, watered, and cared for her part of the corn patch, and now she is going to have sweet corn for supper.

farms in a reasonable and scientific way. The agricultural colleges are teaching farming with as much care as any school teaches arithmetic. They have a course four years long. Some of the boys and girls cannot remain four years, and therefore special two-year courses are arranged. Short courses of six to twelve weeks are held in winter so that grown-up farmers may have the benefit of the instruction.

At these colleges young people are taught how to manage a farm, how to conduct a dairy, how to judge and care for animals, and even how to become veterinary surgeons. Many who cannot go to an agricultural college for even a few weeks are taught by correspondence courses. High schools are offering courses in agriculture.

The Federal and State Governments are also helping to teach the farmer. Trains are run through different parts of the country, stopping at every little town so that lecturers from the state agricultural colleges may speak to the farmers and show them the best ways of carrying on their farms at a profit. Weather predictions are sent to every little post-office, and are then telephoned over the district. Bulletins are mailed to hundreds of thousands of farmers in different parts of the country. In many localities country agents are employed to aid the farmers with their advice. The salaries of these agents are paid partly by the National Government, partly by the States, and partly by local funds.

One does not need to own a farm in order to receive help from the Department of Agriculture. If a boy has a single apple tree and finds that here and there in his apples there are hard places or pithy spots, he can send specimens of the apples to the department of agriculture; and before long he will receive a courteous letter from Washington, telling him what the trouble is and what to do to remedy it.

The Government is always on the watch to discover new plants that will be of value as food for either people or animals. This introduction of new plants makes it easier to change the crop each year, that is, to practice rotation of crops. This is an advantage because the insects and diseases which attack one crop will usually die out if a different crop is grown the following year. Much of the land that was long regarded as of little value because of its dryness has been made valuable by irrigation. In this work both the Federal Government and the separate States have shared, and water has been stored up to flow over this land in the dry seasons.

Both National and State Governments are much interested in children's farming. In many States the boys are invited to see what they can do in raising corn, and the girls to see what they can do in dressmaking, jelly-making, raising and canning tomatoes, and indeed in almost anything that would add to the comfort and pleasure of their homes. The young people go to work with a will. How well they succeed you may know from the fact that the champion corn-grower is a boy of sixteen who raises four times as much corn to the acre as the average farmer. In Ohio nearly one thousand of the young folk who had done the best work were taken on a tour to New York, Philadelphia, and Washington. They were divided into "companies," each company in charge of a "captain"; and they saw the sights, were introduced to the President, and had fully as many feasts as were good for them.

There are numerous things about managing a farm that cannot be found out unless people experiment, and few farmers can afford the time or the money to do a great deal of experimenting. To carry on this work the Department of Agriculture and the various agricultural colleges have established a large number of "experiment stations." Hundreds of scientific men are working at these stations. They study to find out how the land may be made more fertile. They ascertain the best way to drain the land if it is too wet, and the best way to irrigate it if it is too dry. They search out the best manner to carry on dairy work, to feed and care for animals, to keep bees, to get rid of weeds and troublesome insects, to cure diseases of plants and of animals, and to make things convenient and pleasant about the home. Their bulletins, telling what they have learned, are sent free of charge to thousands of persons. Nothing is too small and nothing too large for an experiment station. One bulletin may describe a new drinking-cup for hens, and the next one may suggest a way to increase the cotton crop of the country.

The old farming was haphazard; the new farming is scientific. When a crop fails, the scientific men set to work to find the cause and the remedy. For instance, it is important to know what seed is best to plant. At the experiment stations they test the different kinds of seed. Moreover, they have taught the children in hundreds of country schools how to do this for themselves by using what is called the "rag-baby test."

Let us suppose that twenty ears of corn are brought in and the children are asked to find out which ones will come up best. This is the way they set about it. They take a piece of heavy sheeting about two yards long and mark it off into twenty squares. Upon each square they put six kernels from one of the ears, being careful to mark both square and ear with the same number. They sprinkle the cloth with water, roll it up, and tie it loosely to keep the kernels in place. This is the rag baby. It must stand in a pail of warm water for three or four hours. Then the water is drained off and both pail and baby are wrapped in newspapers. Two days later the baby has another bath. In about a week the cloth is unrolled. The ears of corn whose six kernels have all sprouted are good to plant. In 1912 half a million children were taught to test seeds in this manner. They learned also to test the smaller seeds by placing them between wet blotters.

So it is that the Government aids the farmer. There is nothing to prevent an intelligent farmer from being successful; and there is nothing that need prevent a farmer from being intelligent. The Government will do its best to help him; and in so doing will help us all, for it is a gain to every person in the country if the land does its best and provides us with good food at a reasonable price.

II

OUR HUMBLE FRIEND, THE POTATO

If the people who first ate the potato had known about its relatives, I doubt whether they would ever have dared to taste it. Many of these relatives contain poison, among them being the nightshade, the tobacco plant, and the thorn apple. Cayenne pepper is also a cousin. On the other hand, the bittersweet, the egg plant, and the petunia are all related to it. The tomato is another harmless relative, and for a long while people never thought of eating it. They cultivated it in their flower gardens and called its fruit "love apples."

Except the flower, there is nothing pretty about the potato. The plant is rather coarse and rough. The potato itself has neither the graceful shape of the pear nor the beautiful coloring of the apple. It is useful, and that is all. It is a humble friend to everybody, and with the exception of rice, it is eaten by more people than any other article of food.

The real fruit of the potato plant is the small purplish or greenish ball that sometimes forms on the plant and contains seeds. The potato itself is a tuber, that is, a much thickened portion of a branch which grows underground. The business of the roots is to collect food; but the business of the tuber is to store up the food that has been collected. In the autumn the part of the plant which is above ground dies down, except the little seeds, which continue to live in the balls, when there are any; but the tubers merely rest through the winter. When spring comes, the "eyes," which are really buds, grow into new plants; and the potato has so much food stored up for them that they can grow very rapidly. This is the manner in which the potato would live if it had its own way; but except where it grows wild, a potato never does have its own way. Just when it is ready for its winter rest, we dig it up, put it into our cellars, and a little later we eat it.

If the potato could select its own home, it would choose mountain valleys, like those in Colorado, or such places as Aroostook County, Maine, where the soil is rather loose and porous and drains well. It does not like hot, sunny slopes, because too much heat burns it; and of course, as it wants to store up a large amount of food, it prefers good rich land.

A potato is not a seed, but a whole package of seeds, or rather buds. Each "eye" is a bud, so eager to become a plant that unless it is kept cold, it will begin to grow whether you wish it to or not. For planting, the common method is to cut the potatoes into several pieces, but the most successful growers now plant whole potatoes. These need not be large, and therefore in raising the "seed," the growers select their best potatoes, but plant them very thick. In this way they raise in the "seed patch" a large number of potatoes which are small, but are from the best stock.

There are certain qualities which housekeepers prefer in their potatoes. They like them as nearly

POTATO DIGGING IN NEW JERSEY

On a modern farm there is no more back-breaking work with a hoe or a potato-fork. The farmer even digs his potatoes by machinery.

the same size as possible, so that they will cook in the same length of time. Potatoes must not be too large, or they will need too long to cook. The potato that weighs eight ounces, or half a pound, is the favorite. They must have shallow eyes, because then there will be less waste in peeling. Then, too, there is a fashion even in potatoes; and it is now the fashion to buy those with white skins and of oblong shape. It is well worth while to try to raise the potatoes that will sell best, and for this reason the farmer who is willing to take pains in order to get the highest prices often selects a number of good hills and plants the seed from each hill in a separate row. He saves the potatoes from the best bearing row, keeps them by themselves, and plants them the following year. By doing this, he can raise potatoes that will pay well for all his trouble.

As long as the tops are alive, the potato will continue to grow. In the North, as soon as the tops die, the potatoes may be dug. In the South, potatoes are dug as soon as they are large enough for market, even when the vines are still green. In this case their skin is tender, and they ought to be handled with great care.

New kinds of potatoes are continually appearing. They are favorites for a while, then some new variety takes their place. In the War of 1812, there was a naval battle off Portland, Maine, between two vessels, the English Boxer and the American Enterprise. Many potatoes were washed ashore from the English boat, and for years were cultivated by the farmers of Maine under the name of "Boxer potatoes." However, naval battles are not necessary in order to produce new kinds, for if the seeds from the balls are planted, the potato that comes up will almost never be like the one that grew the seed. Thousands of varieties have been produced in this manner, and almost always there are twenty or thirty on the market which are called "standards."

The sweet potato is an entirely different article. It belongs to another family, that of the morning-glory; and as a general thing it likes just what the white or Irish potato does not. It will grow from seed potatoes or from cuttings from vines; and it likes a sandy soil, while the white potato prefers a sandy loam. The little sweet-potato plant needs to be transplanted, and to have entirely different treatment from that given to the white potato. When the white potato is stored, it insists upon having a cold place, but the sweet potato wants to be warm and dry. Its storage-house must be kept at a temperature of 85° or 90° for about ten days after the potatoes are brought in. Then it may go down to 65°.

More than three fourths of the eatable part of the white potato is water. The other fourth is chiefly starch. This starch is in tiny cells; but heat expands the water, bursts open the cells, and breaks up the little grains of starch. That is why a potato that is properly cooked becomes mealy and so soft that a fork will go into it easily. The moment a boiled potato is done, the water ought to be drained off, or else it will soak into the starch, and the potato will be heavy and wet. If potatoes are gathered too soon, the starch is not fully formed in them. They may be boiled, but if they are baked, they are sure to be soggy.

Because of the large amount of starch in potatoes they are valuable not only to eat, but also to use in the manufacture of cotton cloth. The thread is sized in this starch before weaving, and the cloth finished with it after being woven. It is thinner and more penetrating than the common laundry starch made of corn. When starch is manufactured in mills it is made by machinery, but you can easily make it at home. Wash and pare a potato and grate it into water. Let it settle, strain off the water, and in the bottom of the dish there will be a fine white starch. Pour boiling water upon this, and it will be ready for use.

There is much yet to learn about potatoes, and many experiments have been tried with them. In one instance, the outside layer was scraped from the stems of a tomato vine and a potato plant for two inches, and they were kept bound together for five or six weeks until they became one plant. The tomato was then cut below the bandage and the potato above it. The result was a plant that bore tomatoes above ground and potatoes below. This was done only for amusement, but from such experiments as this people sometimes learn new ways of propagating fruits and vegetables.

III

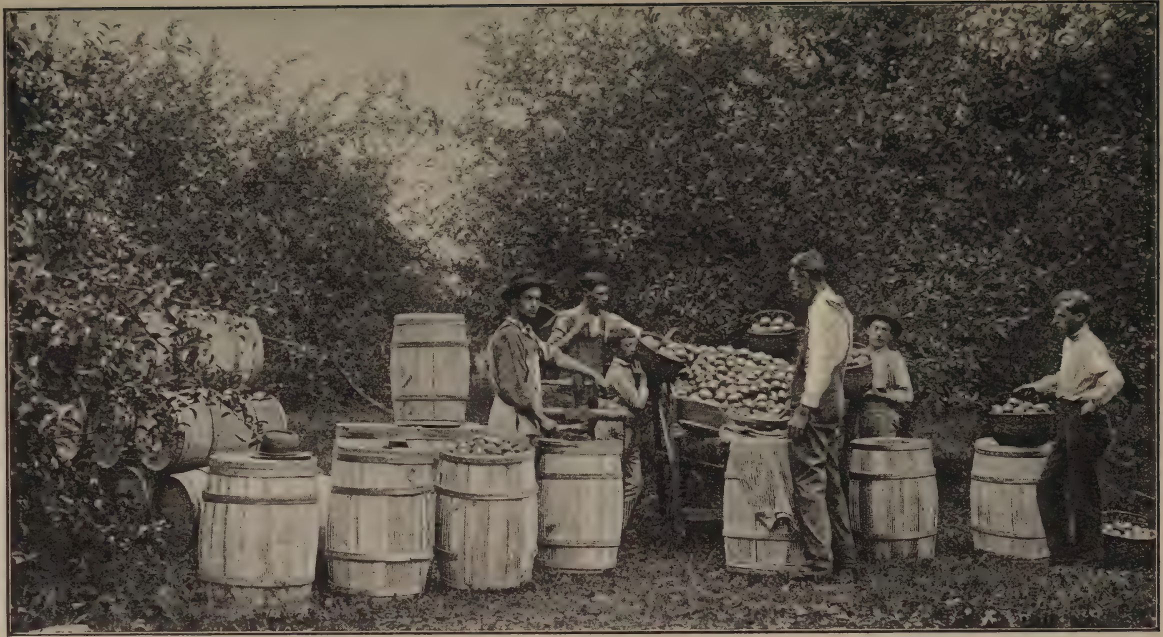
THE STORY OF AN APPLE

I FANCY that most boys and girls, if asked to write what they know about apples, would produce something like this: "Apples grow on trees. Sometimes they are red and sometimes they are not. Some are sweet and some are sour. Some are large and some are small." And really, many of the people who have owned apple trees have not known so very much more.

However, the wide-awake farmer of to-day knows that a tree costs something even if it simply stands and grows, because the land otherwise might be used for corn or wheat or oats. He knows, too, that a poor tree takes up as much room as a good one and calls for as much attention. Therefore he sets out the best trees he can get, and then he gives them good care.

When people first began to farm in this country, the soil was full of decaying vegetable matter. This has slowly disappeared, because it has been used by the wheat and corn and other products that have been raised. To replace this, fertilizers must be used in many places. The intelligent raiser of apples may also plant certain crops to be ploughed under, and so may put some vegetable matter back into the soil. Apple trees must be pruned in order to help them prepare their food properly. The food material comes from the air and the roots and is carried to the leaves. Every leaf is a sort of kitchen in which the sunshine evaporates much of the liquid in this material and makes it into food for the tree. The branches must not be allowed to become so thick that the sunshine cannot make its way in to do this work and also to ripen and color the fruit. In setting out a plant in a new place, some of the roots are cut off or broken, and therefore the plant will not be able to provide food and moisture for all the buds that will try to grow at the coming of warm weather. That is why we often cut off some of the branches in transplanting. Any one who has an old orchard can frequently make it valuable by pruning it, giving it fertilizers, scraping away all dead material from the holes in the trunks and branches, and filling up these holes with cement.

When a man sets out a new orchard, he has no cementing to do, but he has considerable waiting. He has paid for his land and his trees and is paying taxes on them. He is also losing the interest on his money. He has put in the work of a good many days; and even if he has done it himself, it is just as expensive as if he had hired a workman, because he might have used his time for something else. He has planted his trees a number of feet apart, and it occurs to him that while they are small, he might be using this land between the rows for some crop that will pay part of its cost. Peach trees begin to bear sooner than apples, and do not live nearly so long. If his land is suited to peaches, he might plant these



BARRELING GRIMES GOLDEN APPLES IN OHIO

They will be shipped to a commission merchant, who will sell them to a grocer, and maybe you will buy one of these very apples to eat at recess.

for "fillers," as they are called, and cut them down when the apple trees need the room. If he is near a market, he can put in blackberries or gooseberries or strawberries.

There is an old saying that a watched pot never boils; but in the case of orchards, an orchard that is not watched will never bear. There are all sorts of pests to look out for: the borers, that dig into the trunk; the San José scale, that sucks the juice of the tree; the tent caterpillar, that eats its leaves; the codling moth, that makes apples wormy; the railroad worm, that eats its way through and through them as a miner digs through the earth; the canker fungus, that attacks the branches and even the trunks of the trees; and another fungus, called scab, which sometimes appears on the fruit. With these and many more pests ready to destroy some part of the tree or its fruit, it is no wonder that the man who wishes to raise apples has to watch his orchard. His only remedy is to spray his trees; and he counts himself fortunate if one kind of spray will kill two kinds of pests. Then, too, frost may come and injure the blossoms or the young fruit. If the temperature does not fall more than five or six degrees below the freezing-point, he can burn oil or some other fuel and warm up his orchard enough to keep it from freezing.

All through the season the apple-raiser must keep his wits about him. He must not only do his own work well, but he must see that other people do theirs well, which is much harder. When the time for gathering his apples has come, he ought to have eyes on all sides of his head, for it is an easy matter to injure the fruit and spoil its sale.

There is no shaking of trees in the orchards of to-day. First of all, the ladders are brought out. There are ladders with rounds and with steps, and ladders that have no sides, but only a central strip of wood to which the rounds are fastened. There are ladders that are short if you set them up in one way, and long if you set them up in another. There are such ladders as firemen use, that can be shot up into the air and so double their length, and there are Japanese ladders that are pointed at the top and therefore slip in more easily among the branches.

Then the picking begins. The pickers must be taught that apples are not to be handled like cobblestones, but almost as daintily as strawberries. There are as many kinds of articles to pick into as there are ladders. Some use a common half-bushel basket with a handle, but line the basket with burlap. Some use a boat-shaped box that can be opened at the bottom to let the apples out. There are various sorts of aprons, the end fastened up to serve as a pocket, and a strap going around the man's neck. One man put up at the entrance to his orchard a sign saying, "An apple bruised is an apple spoiled." Of course, many men who raise apples do not give them such careful treatment, and in the markets you will see some barrels that have been filled in the roughest fashion. Such apples sell for low prices; and if one is going to raise fruit at all, it will pay him well to raise the best.

After the picking, the apples must be carefully graded. The National Apple Shippers' Association has given rules for grading. For instance, a Baldwin to be marked Number 1 must be at least two and one half inches in diameter. It must not have a scratch or a broken skin or a bruise or any sign of a worm-hole. It must have been picked by hand and must be of good color and shape. The very choicest of such apples as these are selected and marked "Fancy."

After the apples have been graded, they must be put into barrels; not dropped in, but carefully arranged. Did you ever wonder how the apples in the top layers of a barrel came to be so level? That is because when the barrel is to be packed, the packer sets it upside down with the head in and the bottom out, reaches down, and packs the first layer of apples with their stems down. He arranges first the outside row, and then works in toward the center. Generally he packs two layers in this manner. Then he pours more apples in, but very gently, rocking the barrel occasionally so that there will be no space between them. Last of all comes "tailing," which is not an easy job by any means, for the last apples must be packed almost as carefully as the first, only with the stems up. The packer tries to make the layer as level as possible, and rising a little above the tops of the staves. Then the bottom is laid on and pressed down into the barrel so that the fruit will not move about. Fancy apples are often packed in boxes. Such apples are usually wiped, and each one is wrapped in paper. This wrapping is in itself a good advertisement, for it says to the buyer, "My apples are so good that it is worth while to take this trouble."

There is something especially winning about a red apple, and dealers say that a red apple of a rather poor flavor will sell better than a well-flavored one of any other color. Most people have their favorites in flavor, but when they are selecting apples to buy, they are usually inclined to choose the prettiest and most attractive. That is why it pays so well both to cultivate and to pack them in such a fashion that the first glimpse will be pleasing.

IV

SUGAR, THE FOOD FOR HARD WORKERS

If you do a good deal of hard work with your muscles, such as shoveling snow or sweeping or digging in the garden, you may eat sugar, — so the wise folk say, — but if you are rather afraid of work and think it pleasanter to be idle than to be doing something, then sugar is not for you. Sugar is good for mountain-climbers and lumbermen. Long ago it was tried as a food for soldiers on long marches, and it was found that the men to whom sugar was given stood the strain much better than the others.

There is sugar in the sap or the fruit of many plants, but nearly all sugar in the market comes from the sugar cane, the beet, and the sugar maple. In the plant, it is dissolved in water, and all that needs to be done to prepare it for use is to evaporate the water and cleanse the sugar that is left.

This sounds easy, but it requires many processes. The sugar-cane is a kind of grass; but it sometimes grows twenty feet high, and one might be lost in a field of it as easily as in the woods. Its sap is so sweet that both grown folk and babies like to suck bits of the stalk. The canes are cut and carried to a mill, and a machine is set to work to squeeze out the juice. The canes go between rollers that break them and tear them to pieces, and finally send the shreds out so dry that they can be used as fuel. There is a question with which people used to puzzle small boys, "Why cannot a man lift himself up by his boot-straps?" It almost seems as if the sugar rollers had proved that he could, for this dry cane, or *bagasse*, makes almost enough fuel to keep the engines going.

The juice squeezed out is dark and muddy and sticky, and as little like white sugar as anything could be. It does not look as if it could possibly be cleaned. But some wise man found out that if lime is put into it, the lime and the impurities of the sugar will unite and make substances that can be removed. The water is still to be evaporated. Half a century or more ago, a colored man invented a machine that would do this work much better and cheaper than any other. He said to the Louisiana planters, "In the end you will have to use this or go out of business." He went to France and made a fortune from his machine. His prophecy proved true, for the Louisiana planters are now using it.

The liquid comes out of this machine in the form of a thick syrup. It is heated, and must be watched carefully, for the same reason that you have to watch sugar candy when it is boiling. If the candy boils too long, it will turn to sugar; and if you look at this sugar — or some from the sugar bowl — under a magnifying glass, you will see that it is in tiny crystals. The sugar-maker wishes to make crystals, but he must watch the boiling mixture so as to be sure to have them of the right size. When the proper point is reached, the mass of crystals and syrup — *massecuite*, as it is called — is emptied out into an iron vessel shaped like a drum with double walls, and with its inner wall full of holes. This whirls around more than a thousand times a minute, and something remarkable comes to pass. Did you ever notice that if you are riding fast around a corner, you feel as if something was trying to throw you out? That "something" is called centrifugal force, or the force that drives things from the center. This force tries to throw the *massecuite* out through the holes. The sugar will not go through them, but the syrup will, and the sugar is left in the inner drum. It is sprayed with water, then dried; and we have granulated sugar.

There are beetles and borers that do a vast amount of injury to the cane. A while ago the planters in Hawaii learned that in South Africa there was a tiny insect that would devour the sugar-cane pests, and at once they sent a man to get some specimens. There were so many changes of climate on the way home that the insects died. The planters at once sent the man back for more. This time he spent a year on the return trip, staying several weeks at each of a number of places. The insects survived the gradual change and began promptly to carry on their business in Hawaii.

Everybody who ever tasted a beet must have noticed that it was sweet; but beets were seldom used for sugar-making till one hundred years ago, and people were not greatly in earnest about it even then. For one reason, they had not yet discovered the best way of getting the sugar out; and for another, the beets of those days had not so very much sugar. There was only one pound of sugar in sixteen pounds of beets; but they have been so improved that the inedible beets which are now used for sugar contain one pound in every five or six pounds of sugar beets. The beet-sugar mills and the farmers who live near them work together almost as if they were one firm. In the spring the farmer tells the sugar-makers how many acres he will plant, and they tell him what they will pay for his crop. Then their field superintendent takes charge of the fields. This is a gain to the farmer as well as to the sugar-makers, but he does not have to pay anything for the help.

There is another man who has quite as much authority as the field superintendent, and that is the chemist. He tests the juice of the beets to find when it has reached its sweetest point; and none are dug till he gives the word. The tops are left in the field, and the great broad-tired wagons carry the roots to the storage sheds or directly to the mill. They are washed and weighed and sliced thin, and put into water to bring out the sugar. The pulp that is left is given to animals for food; but if they are fond of sugar, they must be disappointed, for in three hundred pounds of this pulp there is only one pound of sugar. The liquid is treated much the same as in the case of cane sugar. There is one great difference, however: the cane sugar is generally carried to refineries to be made clear and white, while the beet sugar is completed at the factory.

Nearly three hundred years ago, a book printed in England said that in America there was a tree which wept if it was cut; and that the juice which flowed from the cut would dry into a sweet substance. This weeping tree was the sugar maple, and the "sweet substance" was maple sugar. There is no factory work about maple sugar; it comes straight from the woods. When the snow has thawed away from the foot of the trees, and the days are bright and sunny and the nights are cold, the sugar-maker bores a half-inch hole two or three inches deep into each tree in his "sap orchard." He puts into the hole a little spout of tin, or of elder wood with the pith pushed out, and hangs a wooden bucket or a tin pail upon the spout. If the orchard is on a hillside, the owner can arrange pipes or narrow troughs, empty the sap into them, and let it run down of its own accord to the sap-house; but few are so fortunate, and most people have to carry it by hand.

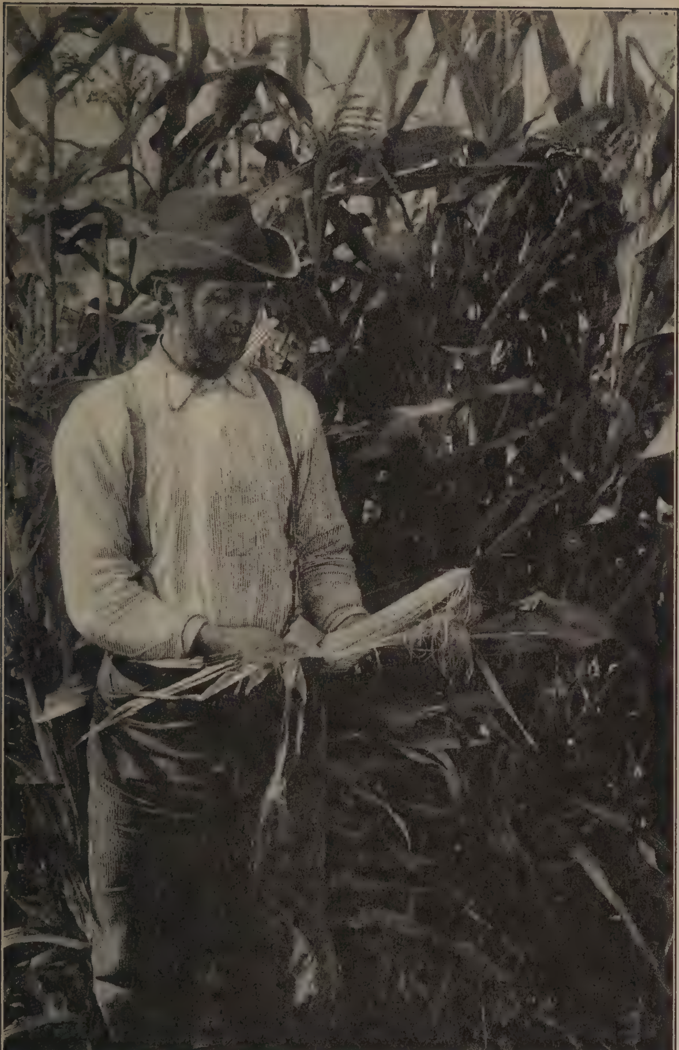
At the sap-house a big fire is built, sometimes out of doors, and over it a great iron kettle is hung by a chain. Buckets and buckets of sap are poured into the kettle, and it boils and boils and boils till the thin sap becomes syrup. So far it has been hard work, but now the fun begins, for it is time to "sugar off." All the young people of the family and all their friends come to help; that is, they run races, whittle out wooden paddles, and snowball one another. There is one person, however, who really does attend to business, and that is the man at the kettle, for syrup burns easily. Pretty soon, if there is not any snow close by, the boys bring up buckets full, and some of the hot syrup is poured upon it. If it sinks into the snow, there is no sugar for them yet; but if it lies on top and cools into a thin sheet, then they may eat their fill of "maple wax," the most delicious thing that you ever tasted. But while they are eating, the syrup is boiling, and before long the wise man at the kettle takes a little birch twig and ties it into a loop. He dips it into the kettle and brings out a film of boiling syrup. He blows upon the film, and if he can blow it into a bubble through the loop, all the older folk hurry to help. The great kettle is swung off. Now everybody seizes one of the whittled-out paddles and stirs with all his might, for much stirring makes the sugar whiter and finer. Before long, it begins to grain. Then it is usually poured into moulds to harden; but if the stirring is kept up, it becomes granulated, that is, made up of little grains.

This is the old-fashioned way of making maple sugar; but now, instead of a sap-kettle, a patent "evaporator" is used; the sugaring-off is done in a big dip pan; and there is no more birch-twig bubble-blowing, for a sort of thermometer is used instead. All this saves time and is more convenient; but I doubt whether the boys and girls enjoy themselves half so much as they did in the oldtime way.

V

A GRAIN OF CORN

A GRAIN of corn put into the ground behaves as if it really knew how to think and plan what would be best for itself. It grows up straight and tall, but it seems to understand that its great enemy is the wind, and so a little way above the ground it sends down small rootlets on all sides to make itself stronger. The leaves are long, but their ruffled edges do not resist the wind, they yield to it, and so they escape being broken. When the time has come for the corn to begin to produce an ear, it first sends up from the top of the stalk what we call a "tassel." This is a cluster of stiff, straight stems, each one covered with tiny flowers. The flowers are not especially pretty, but they have some important work to do. Their business is to make pollen, which looks like fine yellow dust. To produce an ear of corn the pollen from one group of tiny flowers must get to another group of flowers. That is not a very easy thing to do, one would think, for the second group of flowers is growing on what is to be the cob, and both cob and flowers are shut up tight in a wrapping which we call the "husk." The corn has looked out for just this difficulty. From each little flower within the husk a long thread of "silk" grows. These threads come out from the end of the ear and catch the pollen, which goes down through them to



Courtesy Grand Trunk Pacific Railway.

A CANADIAN CORN-FIELD

Corn can be raised successfully over a wide area of North America, particularly in "the corn belt," and some varieties are grown in Canada.

the flowers. Each flower, working together with its friend the pollen, makes a grain of corn. The pollen is so light that the wind carries it long distances. That is why it is not good to have popcorn and common corn grow near together. The pollen will mingle, and on the popcorn cob there will be grains which have no idea of popping.

Besides popcorn, there are three other kinds of corn on the market. One is called "flint" corn, because its kernels are so hard and smooth. Another is called "dent" corn, because there is a little dent at the top of each kernel. "Sweet" corn deserves its name because, while it is growing, much of the starch in the kernel turns to sugar. Popcorn has a hard kernel in which there is a great deal of oil. When the corn is heated, it bursts open. This is why it makes the white, fluffy article that every one likes.

After the corn has been planted and begins to grow, the farmer begins to be anxious. Corn likes warm days, and he is afraid there will not be sunshine enough. But corn also likes rain, and he is afraid there will not be rain enough. Neither the agricultural colleges nor the experiment stations can send sunshine or rain, but they can tell just when the rain is worth most to the corn-field. There is a story of a farmer's son who said: —

"Father, I've just seen six hundred dollars fall upon our farm."

"What? — Six hundred dollars! What do you mean?" exclaimed the farmer.

"At our college," the boy replied, "they say that if during July two and three-fifths inches of rain have already fallen, and then if half an inch more falls before the end of the month, there will be four more bushels of corn to the acre. We have had a little more than two and three-fifths inches, and last night half an inch fell. We have three hundred acres of corn, and three hundred times four bushels is twelve hundred bushels. Corn will sell for at least half a dollar a bushel, and that makes six hundred dollars. Is n't that so?"

The father said, "Nonsense!" But the agricultural college was right, and the crop proved it.

Corn must be cultivated; that is, the farmer must dig around it to loosen the soil and kill the weeds. This used to be done with a hoe, and whenever there was a rest from other work there was always corn to be hoed; but now it is done with a horse-drawn cultivator.

How the farmer harvests his corn depends upon what he wants to do with it. If he does not care much for the stalks to use as fodder for his cattle, he can leave the corn standing till it is perfectly ripe and then pick or husk it, and toss it into his wagon. Another way is to cut the stalks, place them in shocks, and after the corn is dry and has been husked, replace the stalks in shocks, or draw them to the barn for feed. Machines have been invented to do almost everything that there is to do in a corn-field. One sort of machine plants the grain, another cultivates it, another picks the ears, another — the corn-binder — cuts the stalks and ties them in bundles. If the farmer is a good business man, he will not buy a machine till he has reckoned the cost, just as carefully as the owner of a large store would reckon whether it would be cheaper for him to deliver goods by horses or by automobiles. A corn-binder, for instance, costs about $120, and lasts little more than eight years. Interest on $120 at five per cent for eight years is $48. The real cost of the machine would then be $168, or $21 a year.

There are other expenses that must be reckoned in. If he has twenty acres of corn, he will have to pay for team and driver, twine, etc., about $24. His machine will then cost him about $45 a year, or $2.25 an acre. He can harvest his corn by hand for $1.50 an acre; therefore, it will not pay for him to buy a binder. There are, however, two ways by which he can make a binder less expensive; he can take such good care of it that it will last longer than eight years, and he can plant more corn, so that the binder will do more work each year. Possibly, too, he can arrange to rent it to a neighbor.

Corn must be stored where there is plenty of air, so that it will dry. This is why the sides of corncribs or sheds are made of slats which do not come close together. Of course this crib is the very place that rats and mice are longing to get into. One way of keeping them out is to set the crib on posts or stones with pans of galvanized iron put upside down upon their tops. Rats can crawl up the posts, but they cannot get over the rims of the pans.

The best way to keep cornstalks to feed to cattle in the winter is to put them into a silo. A silo looks like a round tower. It is made of wood or stone or concrete or galvanized iron, and is usually thirty feet or more in height. The stalks, generally with the ears still on, are cut into pieces an inch or two long and packed into the silo so closely that air cannot make its way in. This silage ferments and cures and becomes a food which cattle like.

Corn is a food which people, too, are fond of; and any cookbook will show a long list of good things that can be made of it. There is one thing, however, for which it cannot be used; it has no gluten, and therefore it will not make yeast bread, although it will make almost anything else. Most of the starch used in the laundries of the United States is made of corn. Oil that is good to burn, to cook with, or to make soap comes from corn. Even without the grain, the plant is of much value. Very comfortable mattresses can be made of the husk, and paper is made of the outside of the stalk. The most remarkable use of corn is in the building of battleships. The pith in the center of the stalk is so springy and can absorb so much water that it is pressed into blocks and packed back of the armor plate of war vessels. If a ball pierces this plate, the water coming in makes the pith swell, and this closes the hole. Corn is so good a friend that it well deserves the praise that the poet Whittier gives it: —

Heap high the farmer's wintry hoard!
Heap high the golden corn!
No richer gift has Autumn poured
From out her lavish horn!

VI

WHEAT, THE GRAIN THAT IS BETTER THAN GOLD MINES

Which should you rather have, all the gold mines in the United States or all the wheat? If you choose the mines, you will make a great mistake. In the year 1913, all the gold mined in the United States, including Alaska, Porto Rico, and the Philippines, was worth about $88,000,000; and the wheat raised, counting it at seventy cents a bushel, was worth six times as much. Is it any wonder that farmers like to raise wheat, and to raise it in large quantities?

In the Eastern States the soil of a farm is rarely all alike. Part may be rich enough for corn, part a sandy loam that will raise beans. Part may be well drained and suited to barley, and part may be boggy and just the place for cranberries. In Kansas, North Dakota, Minnesota, Nebraska, and other States of the West, there are often vast areas of land that is all of the same sort, and can be planted with the same kind of grain. That is why in these States, and also in California, Washington, and Oregon, you may mount a horse and ride from sunrise to sunset through beautiful golden stretches of wheat. There are neither trees nor hills. There is nothing at all but golden wheat, waving and billowing in the wind, and over it all a bright blue sky, with now and then a bird flying across it.

Of course, these immense fields of wheat cannot be worked by hand. Machines must be used, and some of these machines seem almost wise enough to do their work by themselves. One of the simplest is the hoe drill, which does the planting. This consists of a long box on wheels and is drawn by two horses. The box is full of seed, which falls down through tubes to "hoes," as they are called. These hoes are so shaped that each one makes a little furrow into which the seed is dropped. As a machine has eight or more hoes, it can seed a large space in a very short time.

There are numerous troubles that beset the growing wheat. Among them is a growth looking like iron rust that sometimes appears on it, and there is the chinch bug, which devours it, and the Hessian fly, which sucks its juice; but if it escapes these misfortunes and lives till the straw turns yellow, then the farmer begins to test it to see if it is ready to cut. If he finds the seed full of milky juice, it is not ripe enough. Even if the milky juice has thickened into a stiff paste, the wheat is, as the wheat-raisers say, "in the dough," and too green to cut. If a binder is to be used, the grain may be harvested as soon as this dough has hardened into starch. If it is to be "headed," or harvested by a combined header and thresher, the farmer must wait three or four weeks longer so that the grain will become dry enough not to heat and spoil when put into the stack or bin. In the East, where summer rains are common, wheat must usually be harvested as soon as it is ripe, and therefore binders are generally used. West of the

Rocky Mountains and to some extent in the great plains region, the summers are dry, and the header or combined header and thresher may be used.

At harvest time, if the farmer has only a small field of wheat, he can cut it with a grain cradle. This is shaped much like a scythe, but has four long wooden fingers parallel with the blade. The farmer swings it as he would a scythe; the blade cuts the grain, the fingers hold the stalks, carry them to the left, and drop them in a regular row. This will do the work in a little field, but if a man has miles of wheat to cut, the snow would fly long before he had cut enough of it with a cradle to make any show. All sorts of machines have been invented to help him. One is a reaper, which cuts the wheat and lays it down all ready to be bound into sheaves. Better still, there is a self-binder, which not only reaps, but makes the sheaves and ties them up firmly with twine. Most wonderful of all is the combined harvester-thresher, or "combine," as it is called throughout the West, a marvelous piece of machinery which rumbles along, drawn either by an engine of its own or by twenty-six or thirty-two horses. It does not trouble itself with making sheaves; but it snips off the heads of wheat as neatly as possible, threshes out the grain, winnows it, and even drops it into sacks ready for the market. Some of these great machines will cut a swath thirty-five feet wide, and will harvest one hundred acres a day.

There are both "winter wheat" and "spring wheat." Winter wheat is a hardy plant that does

THE LAND OF THE GOLDEN WHEAT

In harvest time you can ride through mile after mile of wheatfields, shimmering and golden under a wonderfully blue sky. Here and there you can see the harvester at work, drawn by horses or by a great steam tractor, gathering the grain.

not mind being frozen a few times. Indeed, even if it is planted in April, it will not head out till it has passed through a winter. That is why it should be sown in the autumn. Spring wheat is planted in the spring. Then, too, there are "hard wheat" and "soft wheat" and an endless number of varieties of each.

The wheat kernel is covered by five layers of bran. The miller does not wish this to break up and mix with the flour, so when the wheat is brought to the mill, it is dampened to keep the bran from splitting up so easily. Then it is passed through several pairs of rollers. At each passage the meal grows finer and some of the bran, wheat hairs, etc., are separated from it. To make graham flour, the kernel, bran, and all are ground together. Whole wheat flour is the same except that part of the bran is taken out.

If you chew a mouthful of wheat, it will soon become glutinous or sticky. Other grains do not behave so; and this is why wheat flour is so much used for yeast bread. When yeast is mixed with dough, it produces carbonic-acid gas. This bubbles up through the glutinous mass, and so makes the bread "light." Just as soon as the dough has risen sufficiently, it ought to be baked. If it is left too long, it sours and makes soggy, ill-smelling bread, which is not fit to be eaten. Baking-powder is made of cream of tartar and soda; and when these are put together and wet, carbonic-acid gas is set free, which makes the dough "rise" just as yeast does. "Self-raising flour" is nothing but flour which is already mixed with baking-powder, and is ready to go to work as soon as liquid is put in. Unleavened bread is made by mixing flour and water without any yeast. In the State of Washington a few years ago, some wheat was cut, threshed, carried by automobile two miles to a mill, ground, and baked into biscuits, all in twenty-three minutes.

The flour raised in America in a single year would make a line of loaves of bread long enough to go around the earth. George Washington was extremely proud that there was no flour in the world better than that made from wheat which he raised at Mount Vernon. About one fifth of all the food eaten in the United States is made of flour; so it is well worth while to know how to use it properly.

VII

RICE, THE THIRSTY GRAIN

HALF the people of the world eat more rice than anything else. It is the most accommodating of plants, for it will grow on any land that is warm and wet. Indeed, in China it sometimes grows without any land at all; for a man who is not fortunate enough to own any real estate can make a raft of bamboo, put some dirt upon it, plant rice, and thus raise food for himself and family. We use a large quantity of rice in the United States, and until recently nearly all of it that was not imported has been raised in the marshes along the coast and rivers of South Carolina.

When a man sets to work to make a rice-field, the first thing he does is to dig a canal around it, and pile up the dirt that he has taken out into a dike or levee around the canal. Then he digs smaller canals through the field to drain it, ploughs, harrows, rolls it, and sows the seed. The bobolinks, which in the South are called rice-birds, can eat this seed as fast as the planters can sow it; and therefore it is sown before they arrive on their northward journey, and the field is flooded with water from some neighboring river to protect it from them and also to sprout the seed. Much of this seed would float away if it was not fastened to the ground in a wise fashion that rice-planters have invented. They mix clay and

WHERE THE RICE-BIRD FEEDS

When saucy Mr. Bobolink comes back to your meadow in spring he is fat with the sprouting kernels from just such a South Carolina field as this.

water and seed together, then pile up the mass into a pyramid and let it drain overnight. In the morning the seeds are planted, and enough clay sticks to them to hold them in their places when the water is let on. After the birds have left, a second seeding is done.

The field has to be flooded several times, and planters have a special name for each flooding. The first is the "sprout water," because it remains while the seeds are sprouting. The next flooding is the "long water," and the last the "joint water." This remains till the rice is ready to cut. Then the water is drained off, the rice is cut with sickles, and laid across the stubble. On the following day the negroes tie it into sheaves, and a day or two later load it into flat-bottomed boats and pole it away to the drying place, where it is made into huge stacks and stands waiting till it is sufficiently cured to be threshed. Raising rice is not all play. Sometimes, in spite of all the care, birds eat the seeds; sometimes "red rice" gets in and injures the crop; and sometimes, after all the work of the summer, the wind beats the rice down and injures it seriously. Worse than that, the fields are only a little above sea level, and it is quite possible that, just as the rice is ready to harvest, a big storm may drive the salt water all over the field and spoil the whole season's crop.

In 1884, some farmers came from the Northwestern Prairie States to the central part of Louisiana, west of the Mississippi River. They looked about to see what could be raised, and made up their minds to try cultivating rice by machinery, instead of by hand labor. So they set to work in just the way that they had worked on the prairies; that is, they used the gang plough and the disk harrow to prepare the land, and the twine-binder to harvest the crop. All went on well; then came several dry years. The water in the creeks was so low that the fields were from six to thirty-eight feet above it. There was nothing to do but to put in pumps; so pumps were put in, and canals were dug, hundreds of miles of them. Then came a delightful surprise, for it was discovered that under the surface of the ground there were immense strata or layers of gravel, some of them six hundred feet thick, and that these were full of water. There was no more need of digging canals. All that needed to be done was to put down a tube. The water would rise in it to within twenty feet of the surface, and could easily be pumped the rest of the way. This water was soft, not too cold, and never brought a seed of red rice or any other weed. It is no wonder that people hurried from far-away States to Louisiana, or that land which had been valued at twelve and a half cents an acre now sold at thirty dollars. Here there were not the small fields of South Carolina, but wide-spreading prairies of ground firm enough to hold up the heaviest machinery. The cultivation of rice spread into Texas and Arkansas, and the man who tried it first in Texas made seventy dollars an acre his first year. The hand labor of the coast fields could not compete with machines, and therefore little rice is now raised along the coast.

Even after the rice has been grown and the harvesting machine has cut the stalks and bound them in sheaves, there is still much to be done before the rice can appear on the dinner table. First, the seed must be threshed, and now the heavy steam thresher comes rumbling along, and leaves behind it great stacks of straw and chaff and countless bags of seeds. These seeds are called "rough rice," because they are covered with a coarse hull. Next comes "milling," which includes a number of processes. First, the grain is screened, then it is put between two milling-stones, which are revolving rapidly. This treatment takes off the husk, and another screening separates the grain from it. This grain is still covered with a floury substance, and over this is a delicate skin. The fashion has arisen of polishing off this skin and flour, and even of covering the grains with paraffine to make them look more shiny and transparent. This is a foolish thing to do, for the most nutritious part of the grain and the finest flavor is in the "rice flour" which is ground off. This outside part is so much more valuable for food that four pounds with the flour left on will satisfy the hunger of as many people as seven pounds without it; and yet we insist upon having it polished! This flour is now given to cattle, but maybe people will some time be wise enough to eat it.

VIII

HOW TO RAISE ORANGES

If you own some rich, sunny land in California, Florida, or Porto Rico, it will be a good place for an orange grove. You can buy young trees from a nursery if you like, or you can raise them for yourself; and the latter will certainly be a more interesting way. If you decide to raise them, you must first of all make some seed-beds about four feet wide and mark off rows six inches apart. Pick some oranges from strong, healthy trees with large fruit, take out the seeds, and plant them. When the little plants come up, you must take the best of care of them. If you do your part, they will do theirs, and when they are six or seven months old, they will be nearly a foot high. Now it is time to promote them, and for orange seedlings the "next grade" is the nursery. All plants like best to travel in the rain; and so for the journey of the little orange trees it will be a good plan to choose a day when the rain is falling.

Thus far, all that you need to make sure of is to have strong, healthy plants; but now it is time to think about what sort of fruit the plants will bear. Of course, you have planted seeds that came from sweet, juicy oranges; but little trees are freaky, and the fruit that your trees will produce may be sour and dry, nevertheless. In the nursery they must be taught to bear good oranges by what is known as budding. Strangely enough, although you cannot trust a plant to bear fruit like that from which its seed came, you can trust it to bear fruit like that of the tree from which it has been budded. Get some buds, then, from the sort of tree that you wish yours to be, slip them under the bark of your tree, and wind waxed tape around to hold them in place. Generally, the little stranger buds seem quite contented in their new home, and when you unwind the tape, they will be found to be growing comfortably. Sometimes, instead of using a single bud, a twig is taken, and its end slipped under the bark. The branches that grow from these buds will bear fruit like that of the tree on which they grew, and the others may be cut away.

After the buds have been growing for two years, the young trees are removed to the orchard; and if they are to do their share in providing people with oranges, they must be well cared for and protected from the "scab" and the "blight" and the "foot-rot" and the "die-back" and "sooty mould" and freezing weather.

In all the centuries that orange trees had been growing, people had grumbled about the seeds and wished that the fruit was seedless; but no one knew how to make it so. In 1872, a consul who had been sent to represent the United States in Brazil heard that sixty miles up the Amazon River there were a few trees that bore seedless oranges. The consul made up his mind that this was a valuable discovery, and sent a native up the river to bring him some shoots of the trees. He forwarded them to the Department of Agriculture in Washington; but the department was not as much interested as the consul, and two shoots soon died of neglect. The other four were given to a lady from California and set out at her home at Riverside. Of these four, one died, and a cow chewed up another. Two lived, but even when they began to bear seedless fruit, the fruit-growers were not especially interested. Some said, "The next crop will have seeds." Others were certain that the fruit would soon grow coarse and rough. But the oranges did not have seeds, and they did not grow coarse and rough, and very soon these same fruit-growers were paying a dollar apiece for buds from the seedless trees. Indeed, the owner had to build a high fence around her precious trees to keep the buds from being stolen.

Before this time, a few oranges had been grown in Florida, but most had been brought from the countries about the Mediterranean Sea. California raised less than five carloads. However, people now became so enthusiastic about the seedless or navel oranges that hundreds set about raising them in earnest, and a vast amount of money was put into orange groves. Very soon, however, these hopeful growers were downcast enough: the oranges were good, but they would not keep. The Government sent a scientific man to find out what the trouble was. He went into the orchards and saw how they were picked, then into the packing-houses and saw how they were packed. Then he said to the growers, "Decay is caused by blue mould, and this is spread by tiny seeds which float in the air and get into the oranges. The outside skin of the orange is as thin as tissue paper. It is the top of millions of tiny oil cells. Mould will not grow in these or on the skin; but the least little scratch opens the way to the white pulp under the oil cells; and this is just where it likes to live. Handle your oranges more carefully than you would eggs, and you will save them."

The growers laughed at this simple remedy, but after a while many of them concluded to give it a trial. They cut their oranges from the trees, leaving a bit of stem, but never enough to scratch any oranges lying beside them. While doing this, they wore canvas gloves, so that the fruit would not receive even the scratch of a finger-nail. They laid the oranges gently down into canvas bags and then into picking-boxes. Just as much care was taken in the packing for market. At the packing-houses the oranges were carried on moving belts of soft canvas. On their way they were graded, and at length all of the same size slid gently into a bin padded with soft, springy cushions. They were then wrapped in tissue paper, packed into wooden boxes closely enough to keep them from moving, and sent to market. They arrived safe and sound, and without a touch of blue mould.

That is the way oranges are packed to-day; and instead of spoiling on a journey they will keep five or six months. The growers pack them in boxes holding two cubic feet each. An advertisement of

THE ORANGE INDUSTRY OF THE HOLY LAND

Most of our oranges come from Florida and California, but many of the European oranges come from Valencia in Spain and from Palestine. This picture shows oranges being sorted and packed in the city of Jaffa.

"96 count" means that there are 96 large oranges in the box; "252 count" means that there are 252 oranges, but of course they are small ones. Riverside has become the greatest orange-producing locality in the world; and the State of California raises so many that if a train of box cars stretched from New York to Boston and six miles farther out into Boston Harbor, she could fill every car with the oranges of one season.

An orange grove is so fragrant that you can smell it a quarter of a mile away. Indeed, if you should shut your eyes, you could find your way to it by following your nose. The bees and the birds come to it by thousands. And yet, when you reach it, you will perhaps feel a little disappointed. The golden fruit and the white blossoms and the polished dark green leaves are very beautiful; but the trees are round and stout, all alike, and are planted in regular rows. They stand in bare brown earth or even in white sand. Between the rows are pine logs all ready to be kindled if there should be danger of a frost. It is all convenient and well cared for and business-like; but for real beauty you need to see one of the old-fashioned groves where the trees came up just as they liked, did not receive so very much care, but produced, some people say, just as fine fruit as can be raised with all the cultivating.

IX

"RAISIN-PICKING TIME"

If you should walk through a California raisin vineyard in December, you would think it a most uninteresting place. It is a great level field, often hundreds of acres in extent. Planted from six to twelve feet apart in regular rows are what look like short brown sticks, dry and knotted. By and by it rains, and flowers of all colors — blue, pink, scarlet, and poppies of gorgeous yellow — spring up all over the field as if by magic. Then the cultivator is set to work between the rows, tearing up the flowers, but loosening the soil so that the rain will sink into it. The brown sticks put forth leaves and the tiny green flowers which by and by will form the grapes.

The vines are surrounded by enemies. Gray spots of mildew and small yellow spots of "vine plague," "leaf-hoppers," which suck the sap from the leaves, tiny red or yellow spiders, caterpillars three inches long, army-worms, cutworms, and grasshoppers, all do their best to destroy the vines. If these pests do not happen to appear, the owner of the vineyard can take a vacation through June, July, and August; but there is small chance that at least some of them will not show themselves.

Early in September it is plain that something is going to happen. Wagons drive slowly along the roads that run through the vineyard. These wagons are heaped up with wooden trays about three feet long, two feet wide, and two inches high, which are set down at regular intervals between every two rows of vines. The sound of hammers is heard, blow on blow, for men are hard at work nailing together packing-boxes. The roads are full of teams. Everybody is hurrying and bustling, for the time of raisin-picking, the great event of the year, is at hand.

Tents have been pitched, and the people who are to occupy them are already on the way. Some of the pickers are white, some yellow, some red, and some brown; for Americans, Scandinavians, Chinese, Indians, and Mexicans are all coming to help gather the grapes. At first they straggle along, one or two at a time; then come little groups and families, and at length large companies or gangs. Some are on foot, some have mules or horses. There are many boys and girls among the pickers, for the schools close to give the children a chance to earn a little money by healthful out-of-door work.

The grapes are not right for picking until their juice shows a certain amount of sugar. The grape-raisers can usually tell by the taste and color when that time arrives; but if they are in doubt, there is a little instrument called a "saccharometer," or "sugar-measurer," which never makes a mistake.

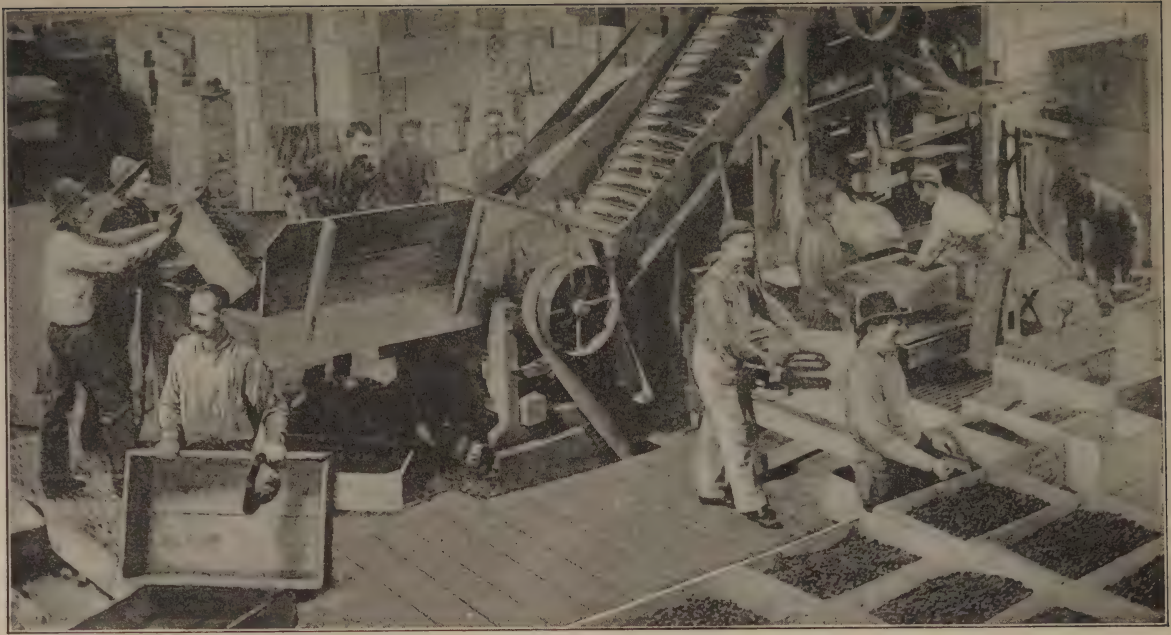
When the proper time has come, the pickers set to work. They are sent first to the poorest part of the vineyard, for there are several things to learn about picking grapes for raisins, and the grower has no idea of letting green hands spoil his finest harvest. They must be taught to pick only the ripest bunches; they must not touch the grapes themselves, but must take hold of the stem with one hand and snip it from the vine with a sharp knife held in the other. The stem must not be cut at haphazard, but close to the vine, so that its end will be a little broader than the rest of it. This is "for looks," and is done only in the case of the large bunches which will lie on top of the packed raisin boxes. Often a bunch is so far in among the vines that it can hardly be taken out without losing some of its grapes. In such cases, the picker is allowed to cut away a branch or two to free it, but he must be taught not to cut away too many and to be sure to cut the right ones.

After the picker has been taught to work, and holds a fine bunch by the stem in his left hand, what is he to do with it? First, he picks off from it every green grape and every one that is shriveled or sunburnt, and every bit of leaf or straw that clings to it. Then he lays it carefully upon one of the trays, putting the bunches as close together as possible. This is the way the finest bunches are picked, — the kind that lie, fat and flat, on top of the boxes in grocery stores, and try to make you think that all the raisins under them are just as good as they. Picking the smaller bunches, however, is another matter. They are laid on a different tray, and the picker does not trouble himself even to pick off the bits of straw, but leaves it for a machine to do.

After the grapes have been laid in the trays, they must cure and dry in the sunshine. In the places where raisins grow, there is seldom a drop of rain in raisin-picking time; but if one of the rare rainfalls begins, all hands must rush to the vineyard, whether it is day or night, and help to pile the trays into stacks to keep the grapes from getting wet. It takes about two weeks for the raisins to dry. Of course they have to be turned at times, so that both sides may be cured alike. An empty tray is laid on top of the full one. Two men take hold of the sides, give a swing, and the bunches are all in the second tray without the loss of a grape. The tray on top is now removed, and the moist side of the bunches proceeds to cure.

Just when the raisin is dried enough is a thing that must be learned by experience. If you pinch it and even the least bit of juice comes out, it is too soft. If it is so hard that you cannot feel the pulp move about under the skin, it is too dry. Of course, it would not be possible for all the grapes in a bunch to dry exactly alike, and therefore the next step is to put them into long, shallow wooden boxes, called "sweat-boxes," which are left in a closed room for a number of days. Here the raisins that are too moist become dryer, and those that are too dry become more moist.

The small bunches and those that are to be sold as "loose Muscatels" are not treated so daintily. They are dropped into a machine which breaks them from the stems; then into another which blows away the bits of stem, the dirt, and the leaves; last, they are



THE CALIFORNIA RAISIN INDUSTRY

Sorting and packing raisins. The conveyor in the center is carrying raisins to the seeding machines.

run through screens which grade them according to their size. Three grades are made, the best called "four crowns," the next best, "three crowns," and the smallest, "two crowns." The seeds are sometimes taken out of the raisins by machinery. In that case, the fruit becomes the "seeded raisins" of the stores. There are two or three varieties of grape entirely without seeds. At present these are small, but some day the growers will learn how to make them large and plump.

Packing is the work of women and girls, and a merry time they make of it. The packing-houses are usually in town, and when the season arrives, the packers come from all directions, ready for work and also for a good time. Sometimes they camp out in tents in gypsy fashion, and sometimes a party of them rent a house. Every morning they go to the packing-house and set to work. It seems as if it might be easy to lay bunches of raisins into a box, but it really requires a good deal of skill. They must be handled carefully, or else the raisins will drop off, and the stems will break. They are packed into boxes containing twenty pounds, in half-boxes of ten pounds, in quarter-boxes of five pounds, and also in fancy boxes containing two and a half pounds. A sheet of ornamented paper is first placed around the inside of the box, and the bunches are carefully packed in layers till the box is a little more than full. They are pressed down by a weight, the ends of the paper folded over them, and the cover nailed on. Seedless raisins are packed in twelve-ounce cartons.

This is the raisin season of California. It ends with a ball. Every one has plenty of money and a good time; but at last the revels come to an end and the pickers leave the place. Then the owners of the vineyards rejoice in the peace and quiet that they hope to have until "next picking-time."

X

THE LITTLE PEOPLE OF THE HIVE

Do you remember how the little square boxes of honey in the comb look that are for sale in the grocery stores? The box has neither top nor bottom, and yet even if you turn it over, the honey will not drip out. If you should slice off the top of the mass in the wooden square, you would find that it was made of six-sided cells formed of beeswax, and that these were full of honey. The bees can make both honey and cells, but as the material used in making the wax in one pound of cells would make at least ten pounds of honey, it occurred to some wise beekeeper that perhaps the bees would let him help make the cells for them. He found that they had not the least objection, provided he made them of the right shape and size and used pure beeswax. Since then a sheet of wax is stamped in such a way as to form the bottom of the cells and stretched across the box before it is put into the hive.

Amazing things go on in the beehive. Can you imagine a city of thirty thousand or more inhabitants, every one attending strictly to business, and every one doing what is best for all? That is just what a beehive is, for the bees are some of the most wonderful little people in the world.

When the bees go into a hive, the first thing they do is to clean house. If there is a bit of decayed

A MODERN HONEY-FACTORY

Here in the orchard colonies of bees live in patent hives, set out on their search for nectar, and bring their golden treasure home.

wood or dead leaf or any other kind of rubbish, they carry it out, little by little, if they can. If this is beyond their power, they cover it with what is called "propolis," or "bee-glue." Sometimes when a snake or a toad has ventured into a hive, the bees have stung it to death, and then covered it with propolis, really making a mummy of it. If there are any cracks in the hive, they use propolis to fill them up, and so shut out rain and wind. They gather this propolis from the sticky buds of plants and also from such trees as the pine and spruce, which produce resin or gum.

Both propolis and honey are sticky substances, and the bees have a busy time trying to keep themselves clean. Whenever a bee has a moment of leisure, he begins to perform his toilet; and even when he is gathering pollen from a flower, he frequently stops for a few minutes to make himself clean. Bees are also very particular about having plenty of fresh air in their hives, and it is the special work of some of them to keep fanning with their wings, so that the air will be constantly changing.

In every hive there are three kinds of bees; the workers, the drones, and the queen. The workers are the ones that make the honey, and keep good air in the hive. They also act as sentinels. If a bee from another hive tries to enter to steal honey, the sentinels know by the smell that he is a stranger, and if he does not fly for his life, he is soon stung to death. These workers also collect water, for the young bees need a great deal of it. Their special work, however, is gathering pollen and nectar from flowers.

If you look closely, you will see in the center of most flowers a tiny pistil standing up straight, the end larger than the rest of it, and a little moist and sticky. Around this are the stamens, more slender than the pistil, sometimes standing upright and sometimes curving gracefully. At the end of each stamen is pollen, or flower dust; and this is what the bees collect to make into bee-bread. This collecting is good for the plant as well as for the bee. A plant cannot produce seeds unless some pollen falls upon the sticky top of the pistil and grows in it. Some flowers are so formed that if the bees did not creep into them covered with pollen from other flowers, they would seldom be able to produce seeds. The bee, then, is not a thief, but a good friend to the flowers. His body is covered with hairs, and these collect pollen. On each of his hind legs there are tiny hollows like baskets. Some stiffer hairs brush the pollen into these, and the middle pair of legs press it down. As soon as the bee reaches the hive with his load, he kicks it off into a cell. Another bee is ready to pack it down so it will be ready for food for the young bees.

Nectar, of which honey is made, comes from the bottom of tube-shaped flowers like the honeysuckle. Through his proboscis or "sucking tongue," the bee sucks up the nectar, swallows it as far as the "honey bag," and there it is formed into honey. It needs two pounds of nectar to make one pound of honey. When the bee has a load, he carries it home and leaves it in a cell of the comb. Bees have such wonderful eyes that they have no trouble in finding their own hive. They rise in circles high in the air till they catch sight of some landmark which they know. Then they take a "bee-line" for home.

The honey is thin at first, but some of the moisture in it evaporates as the currents of air made by the fanning of the wings of the workers blow over it. When nectar is plentiful, the bees are wild to work, and sometimes they even work by moonlight and keep up this fanning all night long. When a cell is full, it is closed with a coating of wax; and that is what keeps the honey from running out when we buy it in the little boxes without covers.

Sometimes honey is extracted from the comb by centrifugal force, just as syrup is separated from sugar. The waxen top of the comb is sliced off, and the comb placed in a wire basket. This whirls around in the extractor, the honey is thrown out by centrifugal force and drips down through a strainer into a pail or vat, and then is poured into glasses and tin cans for sale. The combs are put back into the hives, and the bees will refill them. If it is too late in the season to make more honey, they may be left near the hives, and the bees will clean them up ready for the next summer. The workers who have not been out for pollen and nectar attend to the work of the hive, keep it well guarded and full of fresh air, see to the honey, and care for the young bees.

The drones are the second kind of bee in the hive. They are large and handsome. They have no stings, no honey bags, and no pollen baskets. They have too short a tongue to gather honey, so that they are not able to work, no matter how eager they may be. They eat the honey which the workers gather. Their lives seem to be exceedingly pleasant, but later, as you will see, they have a hard time.

In a full hive there are hundreds of drones, and there are thousands of workers, but there is only one queen. When she is full grown and the time has come for her to choose her mate, she leaves the hive some bright, sunny morning, flies a little way, then comes back to the entrance, flies again and perhaps again and returns, as if she meant to make herself very sure just where the hive stands. Then she flies up, up, up, into the clear blue sky. The drones from her own hive, and also from all the other hives in the neighborhood, have been waiting, and now they follow her, thousands of them. She sweeps on and on. One after another of them drops back, until only a little cluster of the bravest and strongest remain. Of these few only the one that can fly highest can come up with the queen, and him she chooses for her mate.

The queen is the mother of the colony, and it is from her eggs that workers and drones and queen bees are produced. The queen lives several years, but workers live only a few weeks; therefore, to keep up the numbers in the hive, she must lay a vast quantity of eggs. This she does, sometimes as many as three thousand in a day. She moves about from one cell to another, laying an egg in each. In the common cells she lays eggs that will produce workers; in cells somewhat larger, those that will produce drones;

and in some that are larger still, those that will grow into queens. Wherever the queen goes, ten or fifteen of the workers follow her and bring her honey.

The eggs hatch into little worm-like creatures called larvæ. The bees feed them on pollen, or bee-bread, honey, and water for a few days. By and by they refuse to eat, and spin themselves into cocoons. The workers cover their cells with wax, and the baby bees begin to grow. In about two weeks they break through the wax, come out of the cell as full-grown bees, and are soon ready for work.

The bees are wise little folk, and they have no idea of being left without a queen. They build some large thimble-shaped or peanut-shaped cells, generally on the edges of the comb. These are for queens. The eggs which the queen lays in these are just like the worker eggs; but when they hatch, the bees give them better food, and in some way this, together with the size and shape of the queen cells, makes a vast difference in the young ones.

When the young queen is about two weeks old, she is ready to come out of her cell, and makes a little piping noise. Now there is trouble. The old queen knows as well as any human being that there can be but one queen in a country, and she either kills the young one or else she leaves the hive. If she leaves and two young queens come out at the same time, they fight till one of them has been stung to death by the other. The young queen bee who wins goes about from one cell to another, and if there are any more queen cells, she stings to death the little bees in them. A queen bee never stings any but queens.

If the old queen leaves the hive, she takes thousands of old bees with her, every one of them loaded with honey in order to begin a new comb as soon as they are in a new residence. This is called "swarming." They whirl about in the air, and then settle in a cluster, often on the branch of a tree. The branch can be cut off and shaken in front of an empty hive. They will usually be ready to enter, and a new city of bees has been formed.

But while all this making of honey, caring for the young, and swarming to another home has been going on, the drones have had no share in anything except food. If food is plentiful, nothing happens to them until late in the fall; but if pollen and nectar are not easy to find, the day comes sooner when suddenly the worker bees make a furious rush upon the drones, tearing them to pieces and stinging them to death.

This is the story of the bees and their work in time of peace; but there is a tale of their being of value also in time of war. Some Turks once pursued a Greek vessel, and were just rushing on board, when the Greek sailors hurled at them several earthen beehives. The hives broke, thousands of furious bees rushed out, and the Turks were so stung and so frightened that they surrendered on the instant; and the Greeks, who had put on their masks and gloves, retained possession of the vessel.

XI

HER ROYAL HIGHNESS THE HEN

A POULTRY show is the funniest thing you can imagine. Besides all the other kinds of birds, there are big hens and little hens, black hens, red hens, white hens, and speckled hens. There are hens with curly feathers and hens with feathers like straight hair. There are hens with hardly a sign of a comb, and hens from whose heads masses of feathers sweep down in graceful curves. There are hens with legs as bare as your finger, and hens from whose legs long feathers trail as they walk. There are roosters with bright red combs and feathers as white as ivory; and there are roosters as black and shining as jet. There are roosters that strut about as if they cared for nothing on earth but to be admired, and there are fighting cocks with the sharpest and wickedest spurs you ever dreamed of. They are all alike in one respect, namely, every one of them is making as much noise as he possibly can. That is the way fowls behave at a poultry show, but when they are at home on the farm, they attend strictly to their business of making money for their owner, provided he understands how to treat them.

It took people a long while to find out that if a hen is to do her best work, she must be comfortable and attention must be paid to her whims. In the first place, she likes a dry house. You have heard the

HOW MODERN HENNERIES ARE CONDUCTED

The man who means to make money from his hens sees to their shelter, food, warmth, and general comfort in every possible way.

expression, "Mad as a wet hen." A damp house makes a hen uncomfortable and sick. She likes sunshine. In cool climates, therefore, a sunny hillside is an excellent place to build. She has no objection to living in the attic of her house, and if you give her a good stairway, — that is, a slanting board with tiny cleats nailed across it, — she will walk upstairs in a leisurely fashion and look about her while she is doing it as if she was rather proud of the feat. She likes fresh air, and so her house should be ventilated. In spite of her warm feathers, she dislikes chills; and therefore the house ought not to have draughts. She objects to having her chickens caught by rats; hence the house where the chicks are kept must be so made that rats cannot enter. These things the hen demands; but she is no beggar, and she will do her best to pay for them. She asks only comfort, not luxury, and she does not care a straw whether her house is made of polished rosewood or of old barrel staves, if it is only tight and warm and dry.

The hen's most determined whim is to sit on eggs when she chooses, and not to sit when she does not choose. If she is not ready to raise chickens, no one can make her do it. If she is ready, she places herself on her nest, and there she stays. She will sit on china eggs if nothing better offers, but she is bent upon doing her part to raise some chickens. Nevertheless, a hen is really a very sensible creature. If she is taken from the nest and put into a coop whose floor is made of slats a little way apart, she seems to reason the matter out and say to herself, "Eggs lying on this floor would never keep warm enough to hatch," and she gives up for the time the idea of raising a family.

For three weeks the hen who is to raise a brood sits on the eggs. At the end of this time, she begins to hear little appealing peeps from within them. The chickens want to come out. But the hen is a wise mother. She seems to understand that it is not good to do for a chicken what it can do for itself; so she does not help in the least, and fights any one who attempts to interfere with her management of her household. On the end of the chicken's bill is a tiny scale that is hard and sharp. When it is time for the chicken to hatch, it picks at the shell directly in front of this beak. At length a little hole is made, and after half a day's work there is a crack all around the large end of the shell, and the chicken tumbles out into the nest; that is, if all things go right. If the hen that laid the egg was unhealthy or not well fed, the chances are that the chick will not have strength enough to free itself from the egg and will die. If it lives, the sharp scale will later fall off of its own accord. The hen and her family are now ready to leave the nest and move into a real house. It may be a barrel, lying on its side, or it may be a coop with all the modern improvements; but the hen is positive on one point, namely, that she and her chicks must have it to themselves.

The hen is faithful to whatever eggs are put under her. Sometimes ducks' eggs are used, and the poor hen mother is horrified when her "chickens" insist upon going for a swim. I heard of some eggs of the largest breed of hens being placed under a tiny bantam. Her amazement was very funny a month later, when her chicks had grown so large that she had to look up to them.

Not all chickens are fortunate enough to have a mother. There is a story that a little boy once carried to his father a stray chicken which he had picked up.

"Take it to its mother," bade the father.

"It has n't any mother," said the child; "it has n't anything but a kerosene lamp."

This was an incubator chicken. An incubator looks somewhat like a table with a deep drawer having a glass front. In this drawer is a tray in which the eggs are placed. It is warmed by a kerosene lamp, and has a thermometer to make sure that the heat is right and a hygrometer, or water-measurer, to make sure that the air is not too dry. When the chicks are two days old, they are carried by basketfuls to the brooder. Here they creep under a part of the brooder called the "hover." This is a box standing on legs, and kept warm by felt curtains and a kerosene lamp. The rest of the brooder is called the "nursery," and is the chicks' living-room.

A hen takes the best of care of her chickens. She never allows them to become chilly, but calls them to cuddle under her feathers if it grows cold or begins to rain. If a hawk is to be seen or any other danger is near, she has a special cry which brings them to her as fast as their little legs will carry them. All this a hen does for her chickens; but as incubator chicks have no mother, they need human teachers. They must be taught to go out of the hover to eat and play and then return to the hover. After a while they learn this lesson; then they take care of themselves. In their yard they toss about cut clover and chaff, jump up to get a bite from a piece of apple or cabbage hung just above their heads, run about, and have as fine a time as any group of children. When they are six or eight weeks old, they may be taken to a house. Many farmers have houses that will hold twenty-five or thirty hens and are light enough to be hauled by two horses. A man drives about with cans of water and tubs of food, leaving a supply at each house.

The chickens hatched in March or April will begin to lay in the fall — that is, they will if they have a chance; but unluckily for them, when they are about three months old, they are large enough to be "broilers." In three or four months more, they are good-sized "roasters," and as one or the other they often make their first and last journey — to the market.

The hen is a faithful servant. She lays eggs, raises chickens, and does so well in educating them that her master has hard work to equal her. In spite of all this, her life is a short one and she meets small gratitude; for after she ceases to be a hen and becomes "fowl," there is much grumbling at the table if it is suspected that she has been allowed to live more than two years.

XII

THE WAYS OF THE SHEEP

One day I watched a flock of several hundred sheep making their way through a large city to the ferry. The herder was with them, but he was walking along on the sidewalk with a white handkerchief in his hand, and seemed to be paying small attention to his flock. They came to a place where four streets met. The man snapped his handkerchief toward the left, and his collie dog without a moment's delay turned the flock down the left-hand street. There were three entrances to the ferryboat, and the dog glanced at his master. The handkerchief was snapped toward the middle one, and in a very few minutes the flock were all on board. They had gone through the proper gate and were quietly waiting for what should happen next.

The collie has the instinct to care for other animals, to keep them together, search for them if they are lost, and bring them home. He needs training; and yet I have seen a collie who, without any teaching whatever, took upon himself the daily task of going for the cows. If one was missing, he hunted through the woody pasture until he found her. The collie is the best friend of the herder and the sheep, and even the sheep generally recognize this fact. If another flock comes along, the dog can separate his own sheep from the strangers. If a sheep is buried

COULD YOU COUNT THESE SHEEP?

These are two pens in which part of a great flock is put ready to be dipped. It is not uncommon in the West to see a flock of 5000 sheep.

in the snow, the collie will often dig it out himself, or, if he cannot do this, he will go for the herder. He is brave enough to face a wolf fearlessly, if one comes near his flock; and tender enough to lie down beside a half-frozen lamb and warm it with his own body.

In one of the enormous flocks of the Northwest, sometimes three or four hundred baby lambs are born within a day or two. Often the nights are chilly or wet, and if the lamb is not cared for, it will die. Occasionally it happens that the ewe, the mother sheep, is determined not to care for it. The herders say that this occurs when the feed is going to be scanty. However that may be, she must be induced to take it in charge. One way of bringing this about is by putting them together in a pit. Sometimes one sheep has twins, and another loses her lamb. Then the herder plays rather a shabby trick upon her. Sheep know their lambs not by sight, but by smell, so he ties the skin of the dead lamb upon a living one and introduces it to the lambless mother. She does not stop to consider that lambs are born without overcoats; she gets a sniff of the old skin, and from that moment the comical little lamb with its eight legs and two heads is her own beloved child and receives the best care that she can give it.

I suppose that to a sheep the greatest adventures of its life are when it is sheared and when it is dipped. The shearing is done by bands of men who begin in the South early in the season and work up North. They put up rough sheds or booths where their cooking is done, and early in the morning the shearing is under way. Each man seizes a sheep, holds it between his knees; clip, clip, go the great shears, and in less than five minutes the sheep is sheared. The fleece clings together, and drops off almost like a cloak. The shearer lays it upon a table, and there it is folded into a square bundle and tied up.

Now it must be packed into a great bag. One of these is hung from a frame; a wooden hoop keeps its mouth open, and the wool is tossed in. The packer crowds a little wool into the lower corners and ties a string around them, for the bags will be large and heavy, and these "ears," as the men call them, are a great help in lifting. When the bag is half full, the packer jumps into it and treads down the bundles of fleece. As soon as it is full to the brim, it is sewed up and weighed and is ready to go to market. Good shearers can shear about one hundred sheep a day, and some do much more than this. On the larger ranches shearing is now done with shears run by steam or electricity. A sheep that has been properly sheared by men who are proud of having "never a red stain on the shears" will race away from the shearing-shed, far more comfortable because it has been relieved of six or eight pounds of hot, dusty wool. The sheep-raisers reckon that the wool generally pays for the care of the sheep, and that their gain comes from the sale of the sheep themselves.

The second adventure in the life of a sheep is the dipping, which usually follows the shearing. This is not an agreeable event, but it saves the creature much suffering and often death from a disease called "scab." A tiny insect which gets under the skin causes this trouble, but is destroyed by a bath of lime and sulphur and tobacco. A long narrow trough is made of either wood or cement. The sheep are brought up, and before they know what is going on, they are sliding down an incline into this trough. They swim along to the farther end, and are helped out, looking very forlorn, but entirely free from this insect.

Sheep in the Northwest have a "winter range" in the valleys. If this does not provide food enough, they are fed hay. When summer comes, the herder takes them to their "summer range," far up on the mountains above the timber line, where the grass is rich and sweet. The herders' song says: —

"When the grass gets short below, to the mountains we do go;
The ewes start off like greyhounds, pit-a-pat;
They can beat the fleetest deer or any Texas steer,
While you travel to the music of their blat."

In the summer the herder lives in a tent, but in the winter time he has a canvas-covered wagon with a stove and whatever else he needs for comfort. He never leaves the flock, but once or twice a week the "camp-tender" comes to bring him supplies. The herder has excellent wages, and he has also great responsibility. He must guard against wolves and coyotes. He must see that his flock do not feed where there are poisonous plants. Their feed must be regular. If they have good feed generally, but for a few days it is poor, the wool that grows during those days will be weak and will break. If they are out in the rain and are carelessly allowed to huddle together while their wool is wet, it will mat into a sort of felt, which will injure the value of the fleece seriously.

Some years ago, almost every farm had a flock of sheep, but they can be kept so much more cheaply on the Western ranges that in the East sheep-raising has been almost given up.

Like all other animals, whether four-legged or two-legged, sheep have their whims; and of all the notions that ever entered their woolly heads, the strangest is that of doing just what their leader does. A herder who was sending his sheep through a narrow runway held his staff before them, so that they would have to jump over it and thus be obliged to go more slowly. The sheep that chanced to be ahead jumped over it and the others followed its example. Then the herder removed his staff, but the other sheep continued to jump up into the air just as if the staff had still been there. Often this absurd trait of theirs has led to serious results. Many and many a time something has alarmed the flock and they have started to run. The leader has jumped or fallen over a precipice, and every sheep in the flock has followed him, so that in a few minutes hundreds were destroyed.

Sheep are dainty in their tastes, and unless they are half-starved, they will not eat dirty food. They do not demand china dishes, but they do like a rack or trough to keep their food from being trampled into the dust. They do not carry watches, but they know just when feeding time has come; and if their food does not arrive promptly, they know how to call for it in a language that no one can misunderstand. If they have to wait long, they are annoyed and fretted. Sheep that are fretted will not be well, their wool will be poor, and they will be likely to have short lives. The man who wishes to keep sheep — or any other animals, for that matter — must be gentle and patient and have regard to their likes and dislikes, even to what seem to him only foolish notions; but he who is cross and impatient with his woolly charges may as well give up the business, for he will never succeed as a shepherd.

XIII

CONCERNING COWS

A LONG while ago some one wrote a rhyme telling how to choose a good dairy cow. This is what he said: —

"Long in her sides, bright in her eyes,
Short in her legs, thick in her thighs,
Big in her ribs, wide on her pins,
Full in her bosom, small in her shins,
Long in her face, fine in her tail,
And never deficient in filling the pail."

That is the way a man might put it who wished to advertise for a cow. But supposing that a cow wished to advertise for a master; I think she would write something like this: —

"I want a master who likes cows and understands their ways. If I am shut up in the barn, he must bring me my meals regularly, and not give me water so cold that it will take me half an hour to get warm. He must move about quietly, speak gently, not smoke tobacco, and not scold at me. He must know that cows do not like to change their habits, that they like to be milked at the same hour and in the same order. He must understand that the best cows are the most nervous, and that if they are unhappy and afraid, their milk will grow poor and there will be less and less of it. I want a master who will keep me happy and comfortable and be my friend, and I will pay him well for all his care."

No one needs brains more than the man who keeps cows. The Massachusetts State Board of Agriculture says that half the cows in the State do not pay for their food; but that some herds there, by the sale of milk and stock, give their owners a profit of more than one hundred dollars a year per cow.

Not so very many years ago, the milk raised on a farm was either used at home in the shape of milk, butter, and cheese, or was carried to consumers who lived within a few miles; but now much of the milk that is delivered in large cities is brought long distances by railroad. That is why it needs more care than ever; and most of all, it needs to be perfectly clean. It is one of the best of foods, but if it is not clean, it becomes one of the worst. The barn, the pails, the cow, and everything else that comes near her, especially the man who milks her, ought to be clean. The milk should be cooled at once and kept cool until it is used. When the bottle of milk is delivered at your back door, you should bring it in. If there is no ice, wrap a wet cloth around it, and let it stand in a dish of water out of the sun, but in the open air. Milk will absorb odors just as a sponge will absorb water. If milk in an open dish stands in a refrigerator where there are onions or fish, it will soon taste of them. That is why it ought not to be left in an open bowl or pitcher.

For a great many years butter and cheese were made in farmhouses and nowhere else. At length it occurred to some one that it would save a vast amount of work if farmers, instead of making their

IN CATTLE LAND

This is the unfenced country where range is to be had for the asking and the steers get fat on prairie grass. Thousands of head roam over the big ranches.

own cheese, would bring their milk to a cheese-factory and have a skillful man care for it all together. This was the beginning. There are now more than three thousand cheese-factories in the United States. Some of these are owned by the farmers themselves; others are carried on by manufacturers who buy the farmers' milk. At these factories the milk is kept warm for a short time. Then a substance called "rennet" is put into it which makes it curdle. This curd tastes good as it is, but it is soon cut into bits and the watery whey is drawn off. Then it is put into a press to give it the right shape, and left in a cool room to "ripen." This is "full cream" cheese, because the milk with all its cream is used in it. Unfortunately, there is also in the market what is called "filled" cheese. This is manufactured of skim-milk, and to make up for the cream that has been taken away, other kinds of fat are put in. Canada forbids the making of this cheese.

The cheese-factories were so successful that after a few years butter-factories, or "creameries," were established. The creamery does not want milk, but only the "butter-fat" from it; and so the milk which farmers bring in is tested by an instrument called the "Babcock tester," which tells how much fat is in it, and they are paid accordingly. Several of these factories can make fifteen tons of butter each in a day. Cream is lighter than skim-milk, and so the two can easily be separated by centrifugal force, just as sugar is separated from syrup. This cream contains milk and also tiny particles of butter-fat. If it is shaken or even stirred with a spoon for a time, at the proper temperature, these particles will cling together in masses. Some one once invented a rocking-chair churn whose arms were hollow. The cream was to be poured into them, and then the butter-maker was to sit at his ease and rock, manufacturing butter all the while. In a creamery the cream is poured into great cylinders and the churning is done by machinery. After the buttermilk has been washed out and worked out, the butter is salted and sent to market.

Many years ago, when almost nothing was known of the western part of the United States, our Government sent a party to explore it. On their way back, after many hardships and dangers, they came near the homes of settlers, and caught sight of some cows feeding on the river-banks. These cows looked so peaceful and homelike that the homesick explorers shouted for joy. In these days there are great herds of cattle, not in the East, but in the West. Not very long ago, the Western country was free to all to use for pasture as they chose, and the herds of the cattle-raisers roamed over it as they would. To raise cattle and pay nothing for pasture was an easy way to make money. There was no one to interfere except the sheep-raisers; but between these two sets of men there was often a real warfare. Then came railroads, settlers, homesteads, and wheat-growing; and if a man wishes to raise cattle now, he must own the land to feed them on. The Government helps him out a little. It has taken as "national forests" five times as much land as there is in all of England, and by paying for a permit, the raisers of both cattle and sheep are allowed to pasture their animals on it.

The cattle-raiser of to-day has a ranch and a comfortable house, with sheds for his cattle and dwellings for the herders. In the old days, when the great herds of cattle ran free, there was once a year a "round up." The cattle were surrounded by herders — or cowboys, as they were called — on horseback, and driven to a meeting-place. It was a wild, dusty, noisy time, as the men on their bronchos dashed among the thousands of cattle to drive out those belonging to their employers. They recognized them by the brand, for each cattle-raiser has his own special brand.

After the cattle had been looked over, then followed the branding of the little calves, who had known no other life than to roam happily about the land with their mothers. This branding is thus described: —

"The calves are deftly roped by the hind legs and drawn swiftly up to the fire, where the hot branding-iron is applied. There is a hissing sound as the cruel iron burns its way into the flesh, a sickening, scorched odor follows, and it is over. The little fellow struggles to his feet, quivering with pain."

The branding of the animals continues, although it is now done while they are being driven through a narrow runway, but in other respects there are many changes in cattle-raising. The owners fence off their land so that their herds do not mingle with others. Many of the cattle are housed and fed in the winter. The cowboy has become a herder who mends fences and carries food to the cattle.

When the cattle are about three years old, they are taken by rail to some city where slaughtering is done, and from there the meat is sent about the country. In the great packing-houses, no part of the animal is wasted. Soap, oleomargarine, horn buttons, glue, knife-handles, scouring-powder, fertilizers, and leather are all made of the various parts of the cattle.

XIV

HOW CHILDREN RAISED FLAX

Once upon a time some children who had heard how flax was raised and prepared for linen concluded to raise some for themselves. In the middle of May they planted with flax seed a bed about six feet square. The flax grew to be a slender plant two or three feet high with beautiful blue flowers. The children kept it free from weeds, and when the middle of August had come, they pulled it up in handfuls and tied it in little bundles, being careful to lay it evenly, with the root ends together.

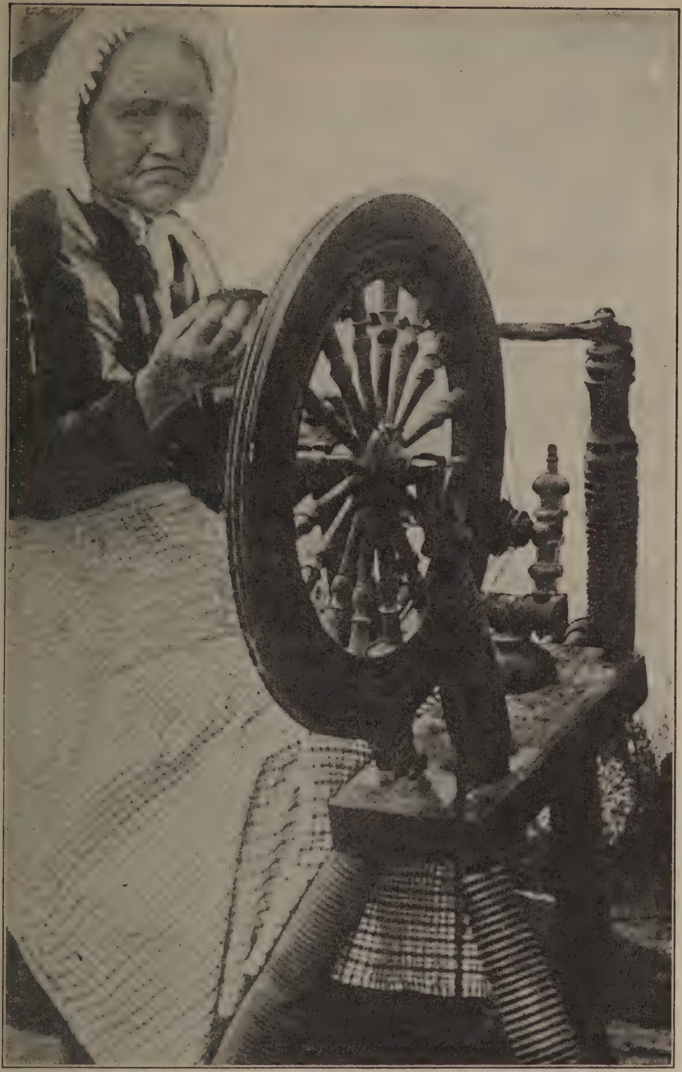
The stem of the flax is not much larger than a coarse darning-needle, but it is made up of three substances, the bark from whose fibers linen thread is made, a woody stem, and a sort of gum which holds these together. The best way to get rid of the gum is to let it decay; so the children laid the little bundles of flax into soft water, being careful that all of it was covered. This process is called "retting." Of course, they tested it every morning; and after a few days they found that the bark was loose from the stem. This was a sign that the retting was finished.

The flax was now spread out on the grass to dry; and as soon as it was well dried, they set to work to free the fiber from the "shive," as the broken fragments of the woody part are called. This process is called "scutching." The flax was laid on a board with a ridge at the sides to keep it from falling off, and there it was beaten with a long piece of wood fastened loosely at one end. After all this beating, a little shaking got rid of the shive altogether, and only the fiber was left. Some of this fiber, however, was short and tangled or broken; therefore, the flax had to be combed, or hackled. The comb was made by driving slender wire nails through a piece of wood three or four inches square. The children held the flax in one hand and combed with the other. The broken pieces were combed out in a snarly mass called "tow," and there remained a hank of soft glossy threads of flax.

This was as far as the children could go, for they could neither spin nor weave; but in colonial days, the women of the households used to spin the flax into a thread and weave it into cloth; and they were exceedingly proud of their snow-white sheets and pillow-cases of homespun linen. The flaxen thread was bleached, and after the weaving was finished, the linen was laid on the grass to bleach again. In New York the young girls of those times used to carry their linen to a field for bleaching. The path by which they went was called "Maiden Lane." Long ago this path became a busy street, but it still keeps the name of Maiden Lane.

In colonial days, cotton cost more than linen, and often a cotton dress was made up with a linen lining. After a while, however, the invention of the cotton gin made cotton goods much cheaper, and little by little people fell out of the habit of raising flax for cloth. Most of the linen that we buy to-day comes from across the ocean. The flax-raisers in Europe carry on the business much as the children did, only on a larger scale, and partly by machinery. The retting is done either by letting the flax lie in pools of soft water, — in Ireland "bog-holes" are used, — or on the grass in meadows, or in a very slowly moving river. The best flax in the world grows in Belgium, around the town of Courtrai. When it is ready to be retted, it is tied in bundles, packed in crates about twelve feet square and three or four in height, sunk into the river Lys, and held in place by weights. The linen from this vicinity has a peculiar soft, creamy, shining look which is believed to be due to the water of this river. Much of the Belgian flax is carried to Ireland to be manufactured, and later appears in America as "Irish linen."

Besides the cheapness of cotton, there is another reason why the raising of flax for linen has been neglected in this country, and this is because it needs great care and skill and much hand work. Wages are so much higher in the United States than in Belgium that a crop needing a great deal of hand work does not pay. Weeding must be done by hand, and the flax must be pulled by hand. One reason for this is that a long fiber is, of course, better; another is that when the flax is to be spun, the skeins or streaks are laid with the ends overlapping; and if the flax has been cut, the square-cut ends produce an uneven thread.



SPINNING FLAX IN IRELAND

Two hundred years ago all the linen was spun in this laborious way and woven at home. The spinning-wheel is seldom seen now, but this old woman has not forgotten how to turn the wheel and draw out the thread.

The United States does not produce much linen, but it does raise flax for the sake of the oil; and to this purpose it has devoted more than two million acres of land. From flax seed linseed oil is made. We do not eat this oil or burn it or use it to oil machinery; but it will dry so much faster than other oils that it is better than anything else to use in paint and varnish. The manufacture of the oil is easy, as it is all done by machinery. One machine gets out the seeds, another crushes them into a fine meal, a third extracts the oil, and a fourth forms the dry meal remaining into cakes that are used as food for animals. Nearly three quarters of the seed raised in this country goes into paint and varnish; the rest is used in the manufacture of oil-cloth, linoleum, and printers' ink.

In Europe flax is raised chiefly for the stems; in the United States chiefly for the seeds, and often the stems are used for bedding for animals or even burned for fuel. This is a wasteful fashion of agriculture, but the difficulty is that flax raised for fiber needs one sort of treatment, and flax raised for oil needs quite another sort. In 1912, the United States raised one fourth of all the flax seed of the world; but very little flax for fiber. This country has large areas of land on which flax would flourish; and if some wise inventor would only bring forward a few much-needed machines, there is no reason why raising flax for fiber and also for weaving linen should not be among the greatest industries of the country.

XV

IN A COTTON-FIELD

If any one should give you a green seed as large as an orange seed, but with a white down sticking closely to it, and under the down a short gray fuzz, it is probably a cotton seed. Put it into the ground if the weather is warm, and see what will happen.

After a while two bright green leaves will show themselves. The plant will grow rapidly till it is from a foot and a half to six feet tall. There will be leaves shaped somewhat like those of the maple, and also many branches. By and by large and beautiful creamy white flowers will appear. They look a little like hollyhocks, as indeed one might expect; for plants, like people, are divided into families, and the hollyhock and the cotton belong to the same family.

When the blossom is one day old, it turns pink. A day or two later it falls off, but it leaves a little boll or round pod. This boll grows until it is about as large as an egg. When it is ripe, it splits open, and a small handful of pure white cotton bursts out. This does not drop to the ground, but clings to the walls of the boll, and also to some little greenish seeds with gray fuzz, like those that were planted. A field of cotton in boll looks as if all the boys in the land had been throwing snowballs.

In raising cotton there is always something to do, and even the boys and girls of six and seven years are able to help. In the spring they "chop" the cotton. It is planted very thick in order to be sure of a crop, and the plants have to be thinned out with hoes, or "chopped." They are left about a foot apart. A plough can be run between the rows, but there are still many weeds left for the children to "chop" out.

There are plantations of thousands of acres, but many have been divided into small plots. A plot of twenty to twenty-five acres is called a "one-mule farm" because one mule can do the horse-work on that area. A plot twice as large is a "two-mule farm." Not only the tenant, but his wife and children, are expected to work; and when a man applies for a farm, the landlord asks cautiously how many children he has and how old they are, to see whether he is likely to be sure of his rent. A family can manage only the land whose growth of cotton they are able to pick. On ordinary land, not poor and not especially rich, about two fifths of a bale to the acre may be raised. The average tenant family rents about sixteen acres, and can raise four or five bales of cotton. A bale weighs about five hundred pounds after the seeds are out.

Some five months after the cotton is planted, the time for picking it begins. The bolls do not all ripen at the same time, and so the field has to be gone over every two or three weeks until the frost comes, which is sometimes well into November. The tenant and his family must all work — indeed, the children with their smaller fingers can often do better picking than their father; and they have little chance to go to school till time of frost. To the large plantations, pickers flock from the country around.

Picking cotton looks as easy as picking up snowballs, but it is quite a different matter. The dainty white handfuls are so light and fluffy that one would expect any stray breeze to blow them away; but in reality the cotton clings so fast to the inside of the pod that it has to be loosened by peculiar little twists and pulls. If not, it will be broken, or some of it will be left behind, or else bits of the pod will come with it. The pickers — black and white, men, women, and children — keep both hands busy, plunging the thumb and forefinger into the open bolls. They wear long sacks of duck, held on by a strap running over one shoulder and under the other arm. At the end of the rows there are great baskets into which the sacks are emptied; or in some places squares of cloth are laid down, one for each picker and his family. Work is begun as soon as it is light enough to see the bolls, and kept up till sunset. Then each man's heap is weighed, and the cotton is carried at once to a barn or storehouse, for evening dews are not good for it. A skillful picker in a fertile field can gather two hundred pounds or more in a day. The average man picks about one hundred and forty pounds a day; if the land is poor, he cannot pick as much. A picker who is not skillful has a hard time, for as he pushes his first and sometimes his second finger into a boll, the points on the divisions into which the boll splits prick the third and fourth fingers, which are folded up, and make them very sore. The pickers have to work in the hot sunshine, they have to bend over in a wearisome way, and they have to carry sacks which grow heavier every minute; but yet they manage to make a good time of the picking season, and talk and sing as they work down the long rows.

There is a machine for doing almost every kind of work, and many people have tried to invent one for picking cotton. Some of these machines, however, not only pick the cotton, but mix it up with pieces of bolls and leaves. One of them ran away and tore up half an acre of cotton before it could be caught and stopped. One of the best has slender arms, on each of which is a chain somewhat like that of a bicycle. This chain has hooked teeth. A workman guides the end of the arm to a cotton boll, the chain is set in motion, the little hooks pull out the cotton, and it is carried through long, curving tubes into great bags. A more recent machine plunges into the plants many little steel fingers about the size of lead pencils. These whirl about rapidly, the cotton winds itself around them, and is swept off by brushes. This machine is so skillfully made that it picks the ripe cotton, but does not injure the bolls that are not ready for picking. It will be a fortunate day for the men who own the large plantations, and even more fortunate for the tenants, if these machines are successful; for the father and a boy can run the machine and leave the mother free to attend to the home, and the children free to go to school. Moreover, the machine would do the work of twenty-five days in

PICKING COTTON IN THE SOUTH

All the family, from the oldest gran'pappy to the youngest pickaninny, turn out when the white cotton-bolls tell them picking-time has come.

one day; and this would give the farmer time to attend to his fall ploughing and make ready for other crops.

But the cotton is still clinging tightly to the little green seeds which are deep down in each boll, and it must be freed from them. People used to pull it off slowly with their fingers; but more than a hundred years ago a young man named Eli Whitney invented a machine called a "cotton gin," which works very much faster. Imagine a row of circular saws with fine teeth which push through the openings between the bars of a gridiron into a mass of cotton and are set to revolving. The teeth tear the cotton from the seeds. The seeds are too large to go through the slits in the gridiron, and so they drop. Revolving brushes remove the cotton from the saws and leave them free to go on with their work. This machine will clear in one day as much cotton as a man could clear by hand in at least six years. Another kind of gin works like the two rollers of a wringing-machine. These revolve, and the cotton passes between them, but the seeds fall down.

Planters used to think that these seeds were useless, troublesome things, and often a cotton gin was set up over a stream so that the water might carry them away. It has been learned now, however, that an oil can be pressed from them which is useful in cooking and in making soap, paint, and oleomargarine. After the oil has been pressed out, the seeds themselves can be ground into meal which is excellent food for cattle, if they are not permitted to eat too much of it. Indeed, the seeds are so valuable that, even if the cotton itself was of no use, it would almost pay to cultivate the plant just for their sake.

After the cotton has left the gin, it is in the form of a lap or flat sheet somewhat like the cotton wadding of the dry-goods stores. This takes up far too much room to be carried on trains and in steamboats; so whatever is not used near the plantation must be pressed into bales. These bales are covered with burlap and bound with steel bands. Then they are ready for market.

Cotton is not all alike by any means. The upland cotton, about which we have been talking, is very valuable; but there is another sort which is worth far more than that, because its fiber is longer and more silky, and therefore stronger and more beautiful. This is called "Sea Island cotton" because it grows especially well on the Sea Islands, off the coast of South Carolina. Its bolls are small and do not open wide, and so it is harder to pick. Moreover, its yield is small, and therefore it pays no more, acre for acre, than the upland cotton. Then, too, it needs more care than the upland cotton and is easily spoiled. If it is damp when it is picked and is stored without being well dried, it loses its luster; and if it is ginned carelessly, its long fibers are broken. But if it has been cared for properly, it is the best cotton in the world, so silky that it is used for making lace, and so strong that the United States mail-bags are woven of it.

XVI

IN A LOGGING-CAMP

When the early settlers came to this country, they found trees much in their way. Trees made forests, and no corn could be raised in forests. Then, too, they were afraid that the dark, shadowy places in the wilderness were the haunts of evil spirits, and were certain that they were full of hostile Indians. Therefore, the settlers went to work with a will to get rid of the trees. They built their houses of great round logs, and in their kitchens they burned logs so large that sometimes a yoke of oxen used to drag them into the fireplaces. When they dared, they set fire to the trees as they stood; and I have no doubt that they would have rejoiced if the whole wilderness had been burned. It did not occur to people that there could ever be an end to the vast forests that were so much in their way.

But after a while wood had to be paid for. Then it had to be brought from a distance, each year from farther and farther away. Portable sawmills were invented that could be taken into the heart of a wilderness. When they left it, the hills were covered with jagged stumps, and the brooks were choked with sawdust. Everybody cut and nobody planted. The result is that some kinds of wood, such as black walnut, have almost disappeared, and that many kinds are becoming more and more difficult to get, and more and more expensive.

Worse than that, this reckless chopping-down of the forests has done much to bring about floods. When rain falls on a hillside grown over with trees, it falls upon ground that is covered with leaves and held together with roots. The water does not run off, but sinks in, and makes its way to the rivers so slowly that their flow is more or less even and regular. If the trees have been cut away, the surface of the soil soon becomes so compact that when a driving rain comes, the water no longer sinks into it, but flows rapidly away and carries much of the surface soil with it. The torrent dashes into the beds of the brooks, rolls down to the rivers; and then there are floods, often destroying fields and houses. The water rushes away into the ocean, and in the summer the brooks are dry and even the rivers are low. If there are mills depending upon these rivers for their power, they have sometimes too much water and sometimes too little. To prevent these disasters and the destruction of the forests, the National Government has bought many million acres of woodland, selecting chiefly the high land where the rivers have their beginnings. Vast areas of forest land have been destroyed by fire; but now many States are glad to join with the National Government in employing men to patrol woodlands, and in 1913 only one fourth as many acres were burned over as in 1912.

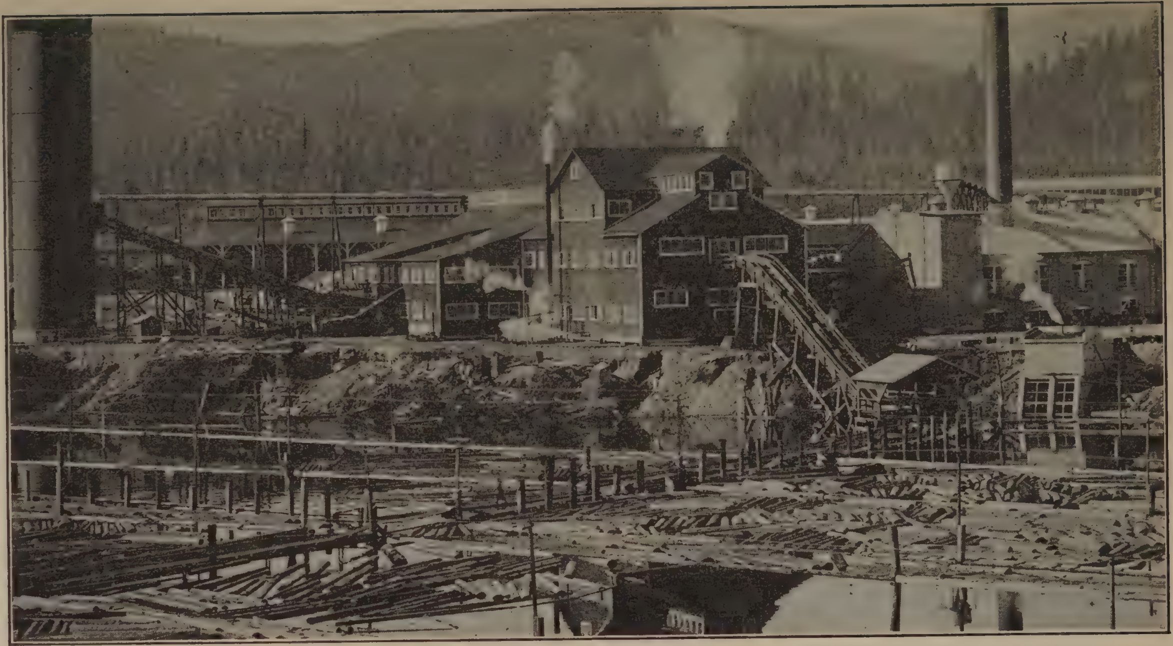
These "forest reserves" do not lie idle by any means. Some of the land is let to herders of sheep and cattle for grazing. In some of it much timber is cut, not in the haphazard fashion of the men who care for nothing but to get as much money from their land as possible, but with wisdom and thought of the future. Trees that have reached their full growth may be cut, but younger ones are left to take their places, and are not chopped down simply to get them out of the way of the falling trunks. More than one third of the income of the forest reserves goes to the States in which they are situated, and is spent on roads and schools. There is no reason why this income should not become a large one, as it is in several European states. Many of the foreign cities own forests. The people of Zürich, in Switzerland, have no taxes to pay because a forest, which they have owned *and taken care of* for two hundred and fifty years, provides the money needed for the expenses of the city. In Switzerland, even if a man owns woodland, he must follow the advice of the government officers in cutting down trees.

Our trees have brought us in a large amount of money. When gold was discovered in California, people swarmed there to make themselves rich; and yet all the gold taken out of California for fifty years did not come to so much as the timber cut in the United States in 1890. On the small farms of the East, when the snow falls and there is little farm-work to be done, the farmer sets out for his "wood-lot," chops down trees for his own use through the year and often some to carry to mill to be sawed into boards. His horses or oxen drag the wood home, and he saws and splits it at his leisure and piles it up to use in his own house. Lumbering in the West is quite a different matter. Often a company is formed to buy the woodland, a few hundred thousand acres, perhaps. Three or four hundred men are hired, and they set out for the wilderness. Where men are to work the whole year through, they sometimes bring their wives and families with them, and each family has its own house; but if there are men alone, they put together a long, low house to eat in and another to sleep in, and they are ready for work. Sometimes these houses are "portables," but often the men build their own, and if a man does not care to live in the bunk-house provided by the company, he is free to build himself a shack. Some of the modern camps are quite luxurious. In one of the Washington camps, a dozen box cars have been made into temporary homes. They are on tracks, and as the men work on into the forest, the tracks are extended, so that there is no waste of time in coming and going. In these cars are steel bunks with good springs and mattresses. There are shower baths, electric light, one car devoted to drying clothes, a kitchen, dining-room, and offices. There is a place to read or play games or write letters. The owners say that this comfort pays indirectly because it attracts a better class of men, and also directly, in dollars and cents. In the old way of making a camp, each move cost at least four thousand dollars, while in the new way the "hotel-on-wheels" costs twelve thousand dollars, and will serve for a long time.

Early in the morning a horn is blown, and the men take their seats at the breakfast table. There are no "light breakfasts" in the lumber camp. An orange and a slice of toast will not do for men who are to fell trees; and the cook reckons upon at least three boiled eggs, three cups of coffee, a mighty plate of baked beans, half a dozen thick pieces of bread, and ham and potatoes enough to accompany them — these are for one man. The food is good, and there is always enough of it.

After breakfast work begins. Each man is hired to do just one kind of work and nothing else. There are choppers, sawyers, loaders, road-makers, teamsters, and swampers. First of all, a skillful man decides how each tree can fall and do least damage to itself and the trees around it. He cuts a notch with his axe about three feet from the ground. Two men set to work with a big saw and cut into the heart of the great tree. After a time they shout, "Look out, now!" and in a minute down falls the mighty trunk with a crash that shakes the ground. Other men are at work. The ring of the axe, the humming of the crosscut saws, and the crash of the falling trees are heard.

After a tree is down, it is cut into lengths of from ten to thirty feet. Each piece is made fast to a long steel cable which is attached to the "drum," or windlass, of a "donkey engine." As the cable winds on the drum, the log is dragged to the skidway. This is



WHERE LOGS ARE MADE INTO LUMBER

You can see the chute up which they go into the mill where iron hands push them into place and a swift shuttle-like carrier takes them to the saws.

a roadway of logs laid like the sleepers of a railroad, but five or six feet apart, and firmly staked down in place. The logs are "snaked" — that is, drawn endwise — down the skidway by oxen. A strong, rough railroad has already been built from "outside" into the forest. The logs are loaded upon the cars, and the stout little engine rumbles away with them, sometimes to the sawmill and sometimes to the river-bank, if the mill is not convenient and the river is.

At the river's edge the logs are dumped. They break through the ice, they pile up in the river; there are thousands of them. With the spring floods the river rises, and the logs rush downstream. Sometimes the river is wide, and they dash onward like an express train; sometimes it is narrow, and they heap themselves up from shore to shore, so tightly wedged that not a log can move. Just as in a game of jackstraws there is often one straw that keeps the others together, so in a jam there is one "key-log" that holds all the others as if with iron chains. At the risk of his life, a skillful lumberman starts to "break the jam." He leaps from log to log, pushing and prying with his sharp cant-hook. Sometimes he cannot break it, and nothing but a blast of dynamite will set it free; but sometimes he gives one well-aimed thrust, the jam breaks, and the whole river is full of logs rolling, tumbling, and pitching. The man escapes to the shore — if he can.

Sometimes the logs are chained together in great rafts. This is often done on the Columbia River. A "cradle," an enormous cradle-shaped frame, is built of heavy timbers on some bit of water connected with the river. A derrick lifts the logs into the cradle, and they are firmly chained together. When the cradle is full, one side of it is pulled away by engines, and tugs tow the cigar-shaped raft out into the river to the ocean, and sometimes seven hundred miles down the coast to San Francisco. Rafts seven hundred feet long have taken this trip in safety; but it is a dangerous journey, and on an average one raft in three goes to pieces on the way. This is a misfortune for the lumbermen, but a great convenience for the farmers along the coast, for the logs that are washed up on the beach afford them a good supply of lumber.

When logs reach the mill, they are dumped into a pond. This protects them from worms and by soaking out the sap keeps it from drying in the wood and staining it. The log ready to be cut is passed up an incline into the mill by stout chains and is rolled to the carriage which takes it to the saws. The head sawyer must be skillful enough to tell at a glance into what size of boards a trunk should be cut, and the "gang-saw," which is thirty or forty upright saws set side by side, cuts through the wood as if it were cheese. In fifteen minutes after a log has entered the mill, it is no longer a log, but has become boards, laths, shingles, slabs, and sawdust.

From beginning to end there is danger. In the woods a fault in a tool or a piece of machinery, a slip of the hand or of the foot, a tree falling just a little to one side — and some one's life may go out. The driving of logs down the river, the breaking of a jam, the chance of being crushed by the slipping of a log from its place, the lightning-like speed of the savage teeth of the great saws into whose clutches one false step may throw a man — there is danger everywhere. There is more than mere amusement in the song that is often sung in camp, the "Lumberman's Alphabet," as it is called, which begins: —

> "A is an Axe, as you very well know,
> B is us Boys who can swing it al-so.
> C is for Chopping, which now does begin,
> D is the Danger that we are all in."

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